THE
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JANUARY 1954

THURSTON SCOTT WELTON, M.D., EDITOR

SURGICAL REVIEW

DUPUYTREN'S CONTRACTURE

HERBERT CONWAY, M.D., New York, N. Y.

SIXTY-THIRD YEAR OF PUBLICATION

JANUARY 1954

THE American JOURNAL OF Surgery

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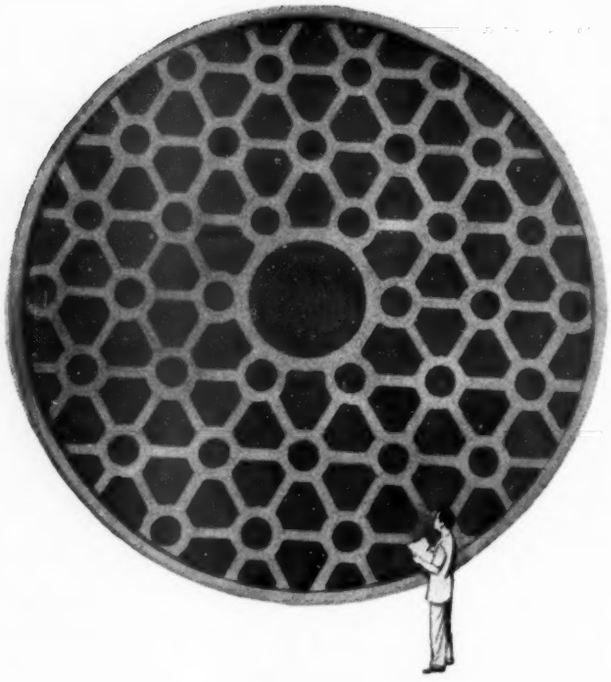

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CONTENTS–January 1954

VOLUME EIGHTY-SEVEN NUMBER ONE

EDITORIALS

1954 1

Hubert A. Royster, M.D. 3

SCIENTIFIC PAPERS

A Comparison of the Gibson Posterolateral and Smith-Petersen Iliofemoral Approaches to the Hip for Vitallium Mold Arthroplasty 4

PAUL R. LIPSCOMB AND JOHN R. BARBER

The authors briefly review the history of the development of two surgical approaches to the hip joint, and present results of 200 Vitallium mold arthroplasties (performed during a two-year period), with critical analyses and comparisons.

Treatment of Carcinoma of the Colon and Rectum. 13

BENTLEY P. COLCOCK

The operability rate in carcinoma of the colon and rectum has risen about 90 per cent and the mortality rate has dropped to less than 3 per cent. From this, one may conclude that any further significant improvement in the end results must come from earlier diagnosis and the detection and elimination of the premalignant mucosal polyp.

Cancer of the Pancreas. A Plea for Total Pancreatectomy 20

DONALD E. ROSS

The author concludes that in malignancy of the pancreas anything less than total pancreatectomy is useless. The technic he employs is described.

Contents Continued on Page 5

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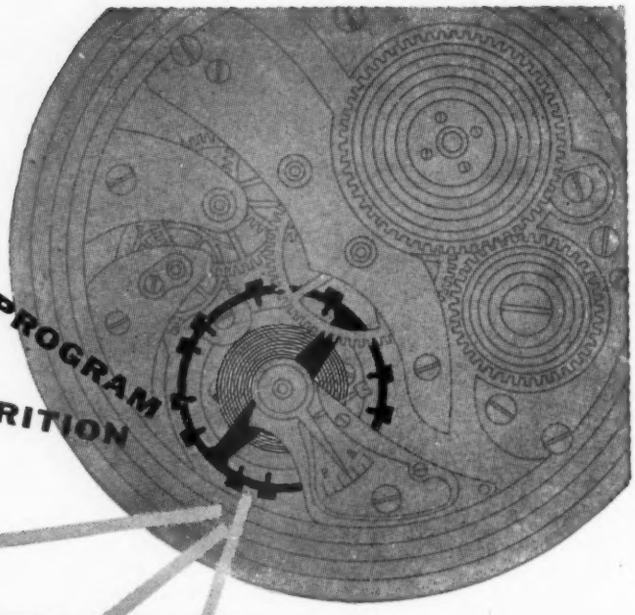

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CONTENTS continued–January 1954

VOLUME EIGHTY-SEVEN NUMBER ONE

Complete Urinary Retention in the Female . . . 34
CHARLES NEY AND RICHARD M. HYMAN
A review of the subject of complete urinary retention in females and a presentation of seventeen cases illustrative of a wide variety of etiologic factors.

Lower Nephron Nephrosis (Ischemuric Nephrosis). With Special Reference to Hemorrhagic Diathesis Following Incompatible Blood Transfusion Reaction. 41
LT. COL. ROBERT M. HARDAWAY, CAPT. DONALD McKAY AND CAPT. JAMES H. WILLIAMS
The authors give the etiology, symptomatology and treatment of lower nephron nephrosis, with illustrative cases.

Osteopetrosis 50
SAMUEL KLEINBERG
The author discusses at length the rare malady of osteopetrosis and presents two cases which are of special interest since they show the disease in its mild form.

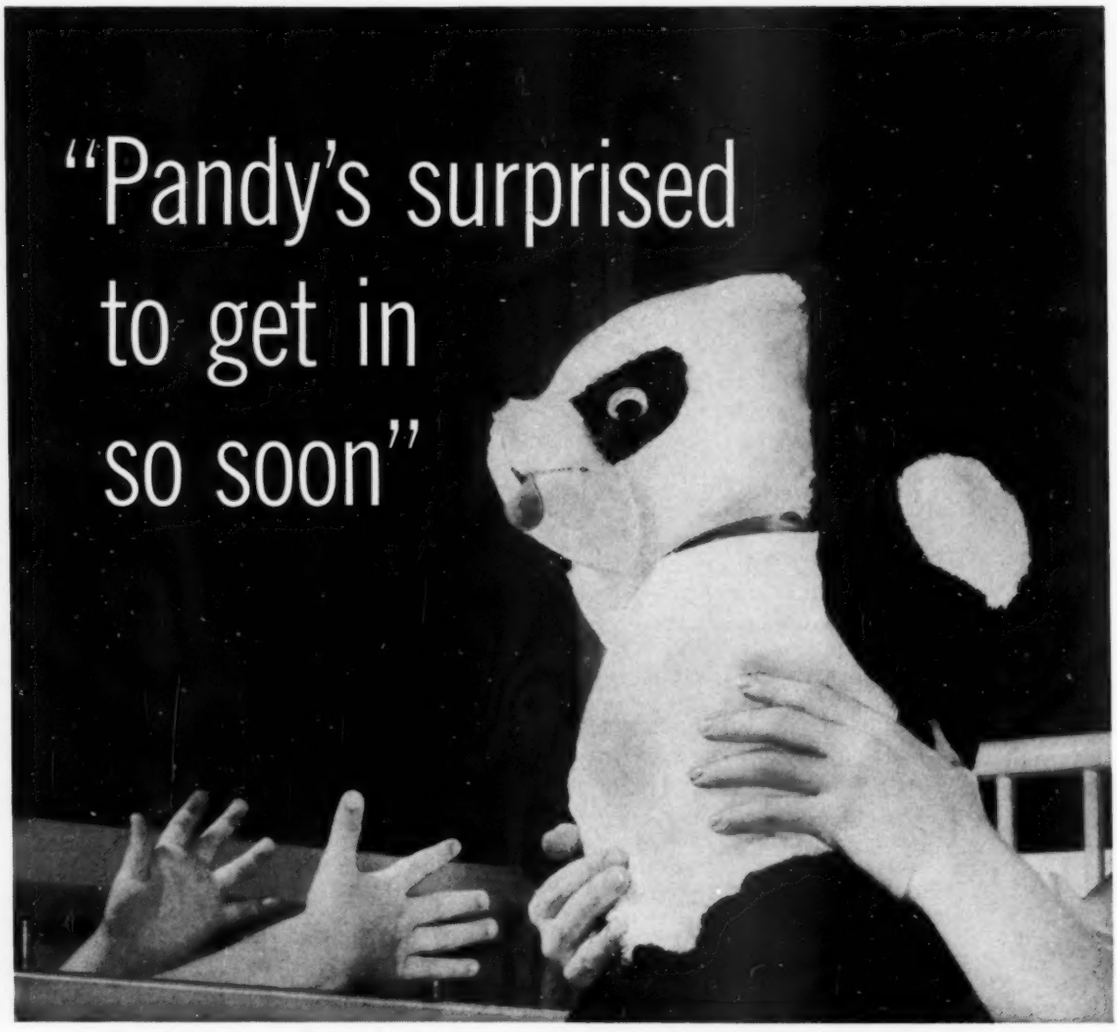
Value of the Intramedullary Nail for Knee Fusion Particularly for the Charcot Joint 63
H. R. BRASHEAR
The author presents four cases of knee arthrodesis using an intramedullary nail. Three of these were cases of Charcot Joint and complications occurred in each of them. In these cases the author concludes the intramedullary nail is of doubtful value.

Somatic Pain and Autonomic Concomitants. Reflex Sympathetic Dystrophy 66
R. J. DITTRICH
From observations in five cases the author concludes that the clinical picture of reflex sympathetic dystrophy is in large part dependent on afferent impulses derived from a pathologic lesion of soft tissue structures in the lower back. Methods of verification and surgical correction.

Local Anesthesia in Facial and Jaw Fractures . . 74
RICHARD M. HERD AND JOHN C. WEETER
A report of a new local anesthetic, positive in its action, rapid in its induction and profound in its intensity, used in the treatment of fifty-six facial and mandibular fractures and other facial injuries with special reference to cerebral injury as a complicating factor.

Causes of Operative Mortality in Chronically Ill Geriatric Patients. II. With an Analysis of Eighty Additional Consecutive Autopsy Records . . . 78
LOUIS CARP
An analysis of the causes of death in eighty consecutive autopsies in patients sixty years and over who died within one

Contents Continued on Page 7



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CONTENTS Continued–January 1954

VOLUME EIGHTY-SEVEN NUMBER ONE

month after elective and emergency surgery between the years 1946–1952. Suggestions are made for possible reduction of operative mortality.

Factors Influencing the Morbidity and Mortality in Burns 84

ELLIOT B. HAY AND THOMAS D. CRONIN

An analysis of 505 burns, with the major factors of determining morbidity and mortality.

Clinical Significance of Thickened Hepatoduodenal Ligament in Infiltrative Carcinoma of the Gallbladder 88

DAVID N. MARKS

The author notes that in carcinoma of the gallbladder there is associated a brawny thickened hepatoduodenal ligament. Six cases of carcinoma of the gallbladder are reported.

Prevention of Abortion 95

EDUARDO F. PEÑA

Ninety pregnant habitual aborters with one to seven miscarriages were given daily massive stilbestrol therapy together with Vitamin B factors and Vitamin C, with loss of but two pregnancies (1 per cent).

The Second Side Inguinal Hernia and Routine Transpubic Exposure 97

JAMES I. KNOTT

The author concludes inguinal hernia is basically a bilateral disorder, and that many patients with a sound single repair will later develop a new hernia on the second side. A routine transpubic exposure will anticipate the second hernia in those cases in which it exists as an unexpanded sac or a mass of pedunculated fat in the canal.

SURGICAL REVIEW

Dupuytren's Contracture 101

HERBERT CONWAY

A review of Dupuytren's contracture covering the history, statistics (incidence, sex and age incidence, hands and fingers involved, race incidence), etiology, symptoms, clinical signs, diagnosis, anatomy and pathology, surgical treatment, operative technic of aponeurosectomy and postoperative care. The author reviews seventy-nine cases observed at The New York Hospital.

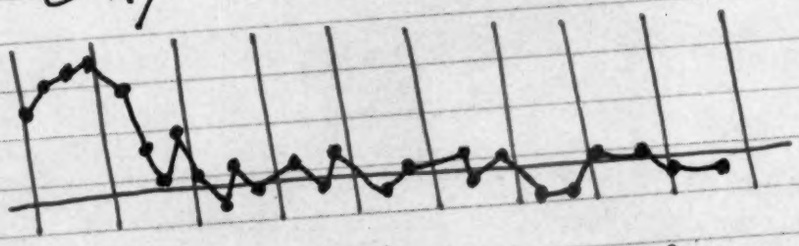
PRACTICAL SURGICAL SUGGESTIONS

Efocaine for the Relief of Post-thoracotomy Pain . 120

BERT H. COTTON AND GEORGE A. PAULSEN

Contents Continued on Page 9

Dx/ Pneumonia



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CONTENTS Continued–January 1954

VOLUME EIGHTY-SEVEN NUMBER ONE

Simplified Intestinal Decompression Sound . . . 122
MEYER O. CANTOR

The Triad of Colostomy Care 127
DURAND BENJAMIN

CASE REPORTS

Primary Carcinoma of the Ureter Associated with Primary Carcinoma of the Colon 129
HENRY A. KONTOFF AND HYMAN HERSHMAN

The authors present a case of primary carcinoma of the ureter that was associated with primary carcinoma of the colon. The literature on primary carcinoma of the ureter is reviewed.

Endometrioma of the Sigmoid with Vicarious Menstruation and Intermittent Intestinal Obstruction . 133
GORDON F. MADDING AND FRANCIS M. SPENCER

A case of endometriosis of the sigmoid with subacute and intermittent intestinal obstruction associated with vicarious menstruation.

Unusual Type of Metastasis for Carcinoma of the Breast with Coincidental Development of Diabetes Insipidus 137
IRVING A. LEVIN AND AMBROSE J. HERTZOG

A case of a forty-five year old woman who underwent radical mastectomy for carcinoma in 1950, and, two years later, panhysterectomy for uterine leiomyomas (with isolated metastasis in one ovary and the uterine myometrium). There was also simultaneous development of diabetes insipidus. Patient is living three years following mastectomy and fourteen months after panhysterectomy.

Traumatic Perforations of Colostomies 140
ELMER HOFFMAN AND ALLAN MACHT

The literature on perforation of colostomies is reviewed, the proposed theories of causation summarized, methods of prevention discussed and two illustrative case reports are reviewed.

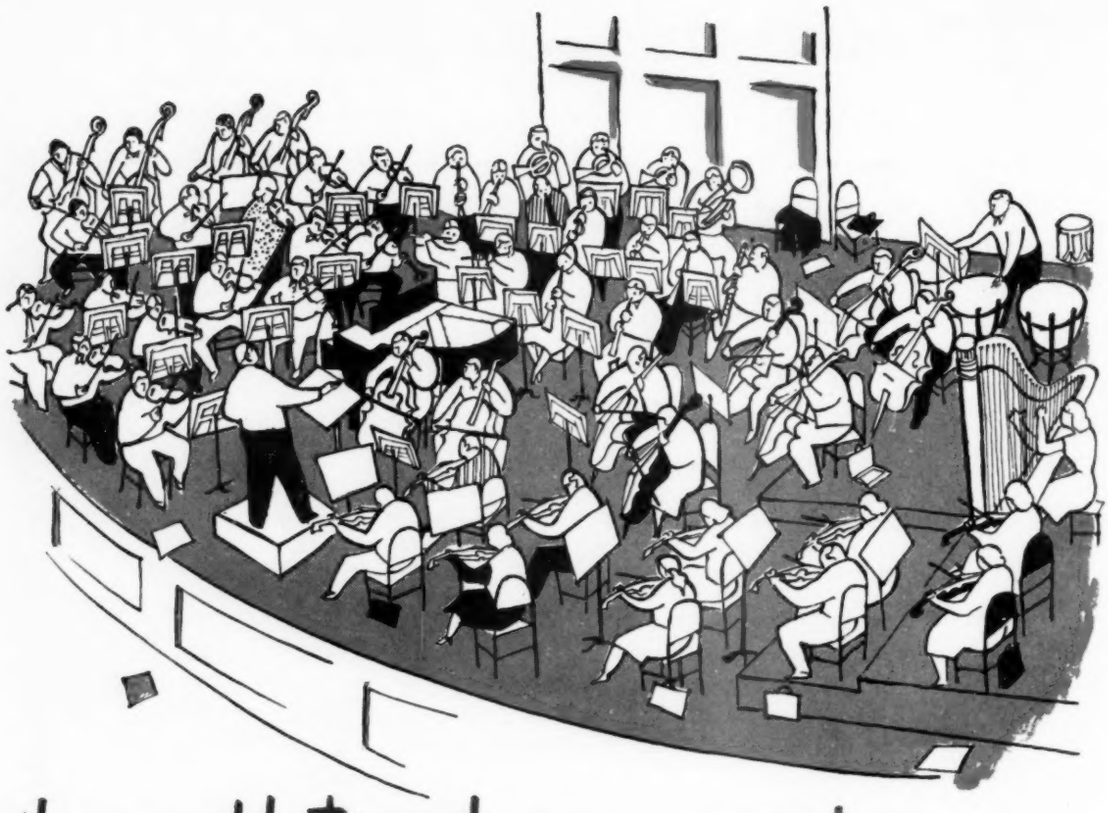
Hemangiopericytoma of the Ileum 143
WILLIAM P. SMITH AND ROY E. SWENSON

A report of an unusual case, that of hemangiopericytoma of the ileum.

Osteochondroma of the Astragalus 145
ROBERT AUSTIN MILCH

An unusual case of osteochondroma and a brief general review of the subject are presented.

Contents Continued on Page 11



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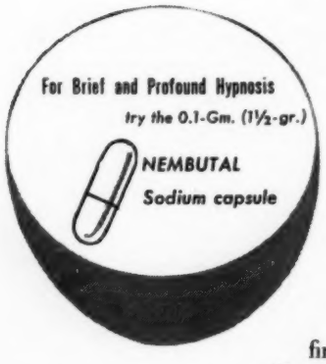

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CONTENTS Continued–January 1954

VOLUME EIGHTY-SEVEN NUMBER ONE

Primary Carcinoma of the Liver Presenting Itself As an Acute Abdominal Condition 149

ERMIN R. CARDI AND JOHN J. VALLONE

The authors present a case of bile duct type (cholangioma) carcinoma of the liver making its appearance as an acute abdominal condition.

Intussusception of Ileum with Expulsion of Intussusceptum per Anum 152

FRANK TROPEA, JR. AND VITOL S. SHEPARD

The authors present a case of intussusception with spontaneous expulsion per anum of the intussusceptum and recovery.

NOTES AND QUOTES 44

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3. M. C. Cobey, M.D., F.A.C.S., Washington, D.C., private communication.

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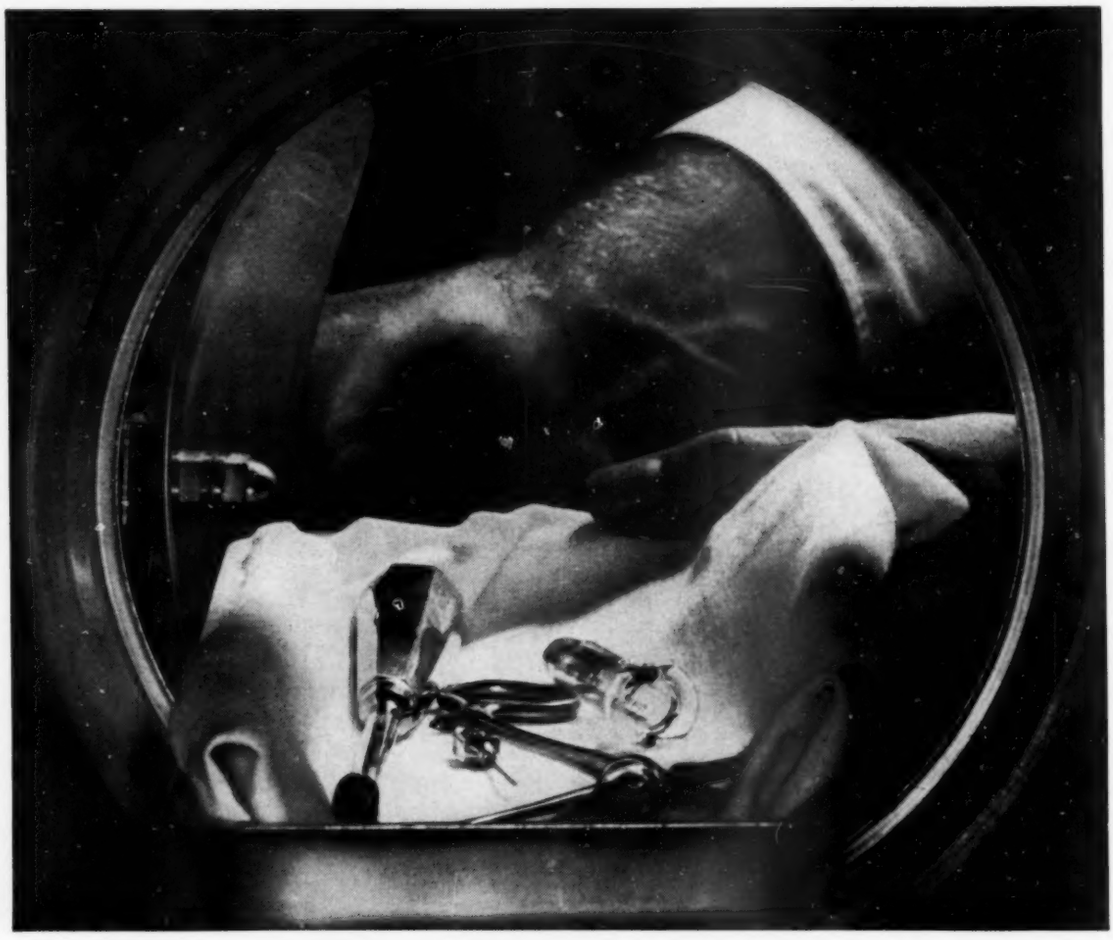

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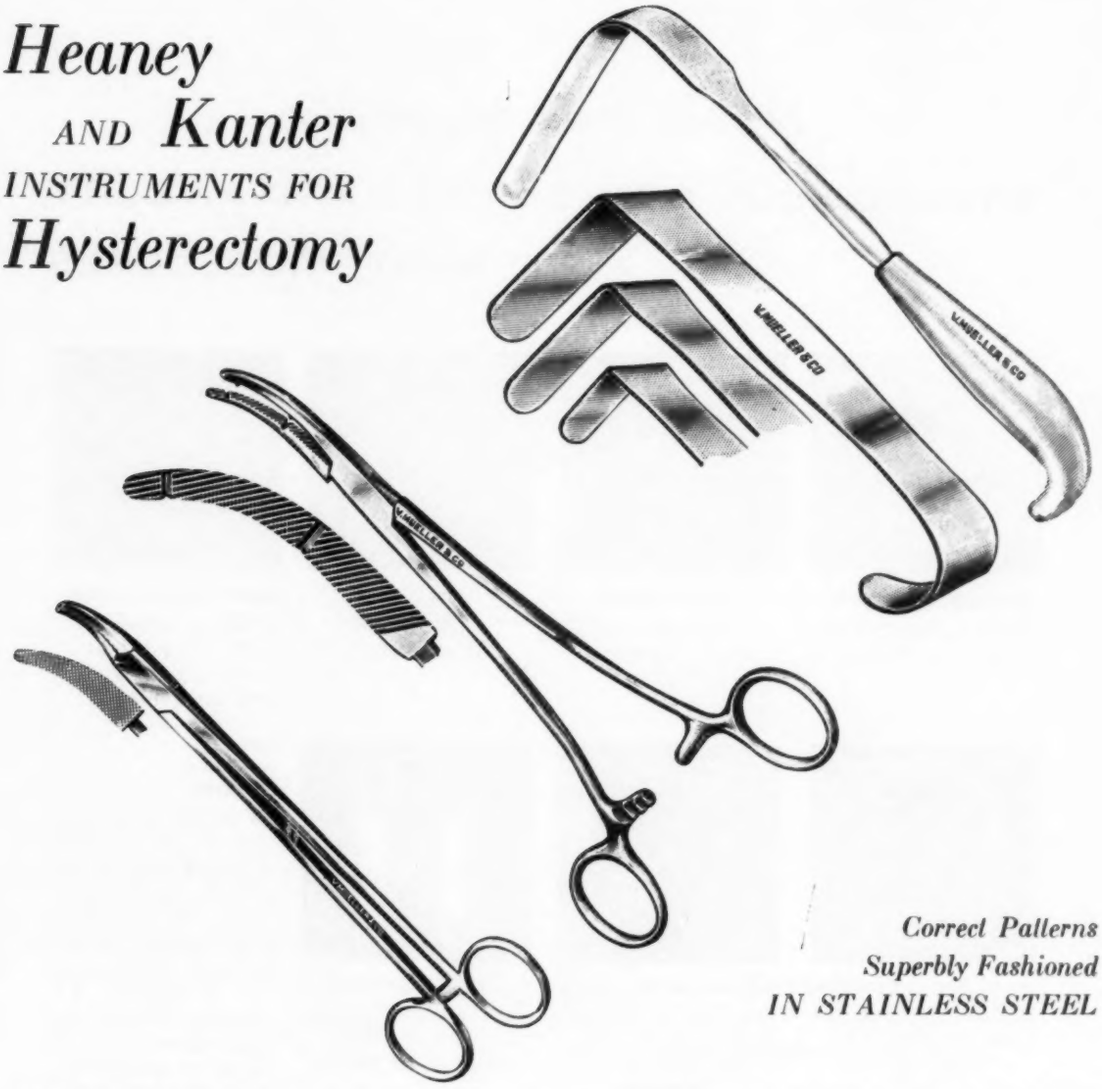

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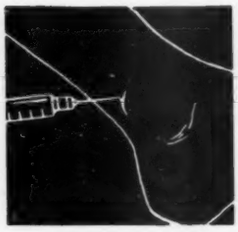

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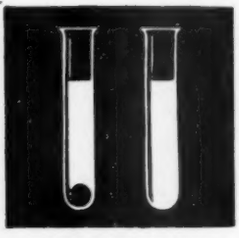

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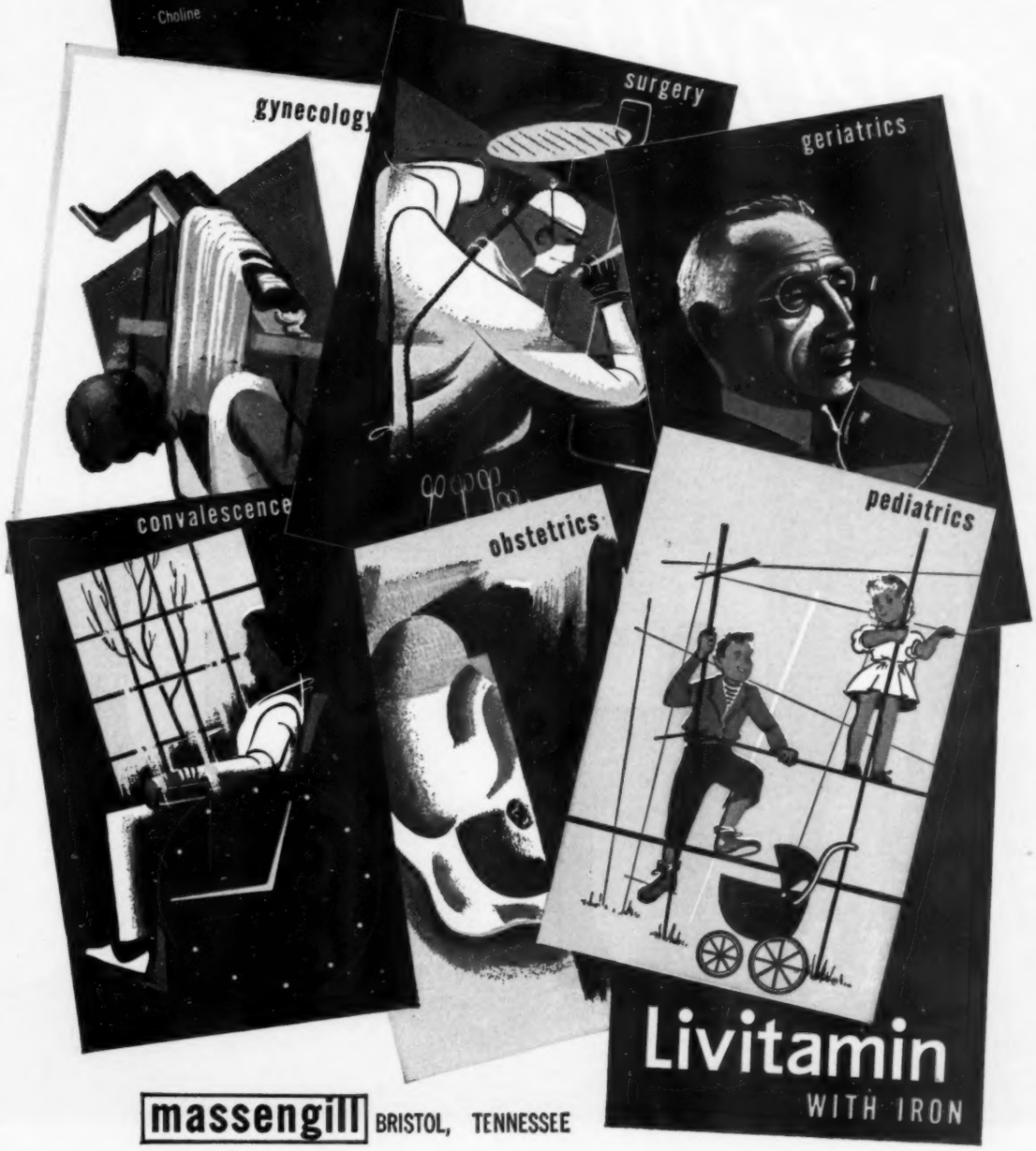

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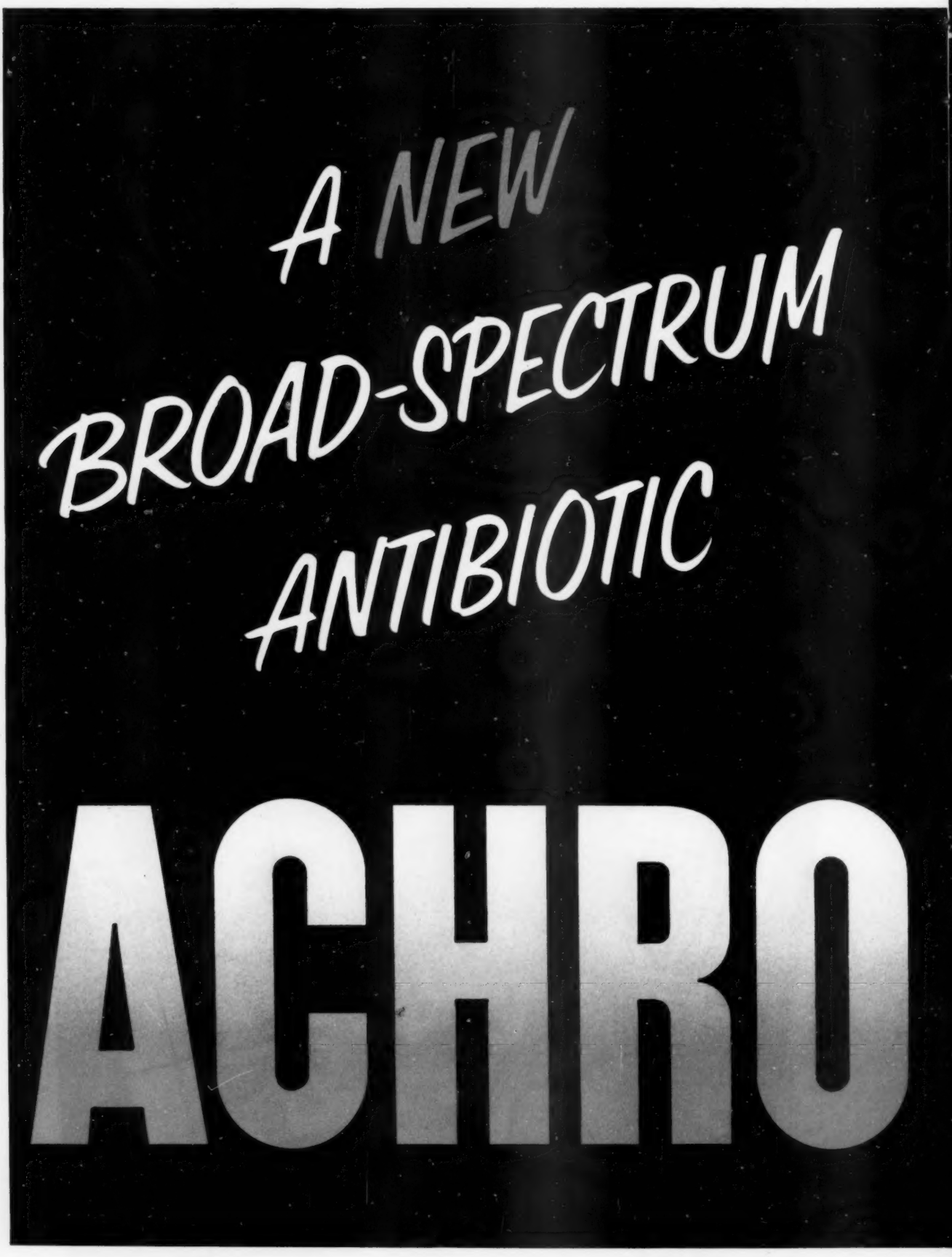
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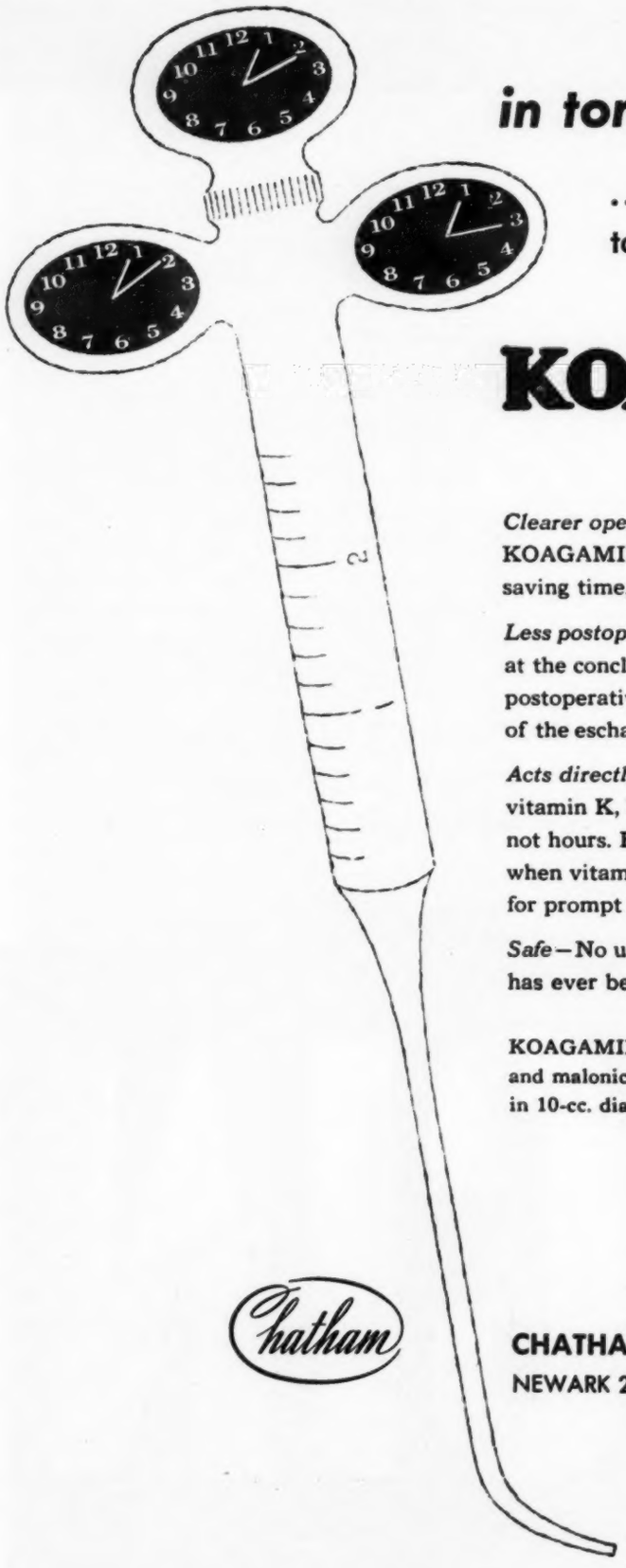

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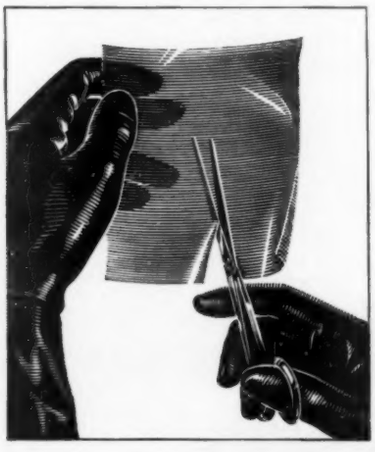

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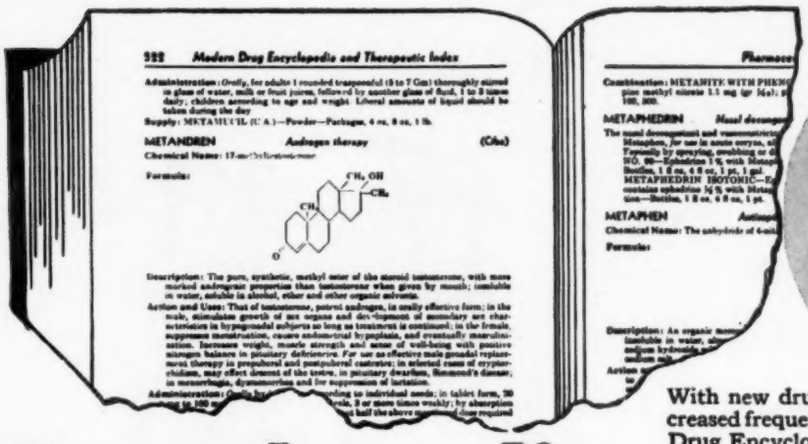

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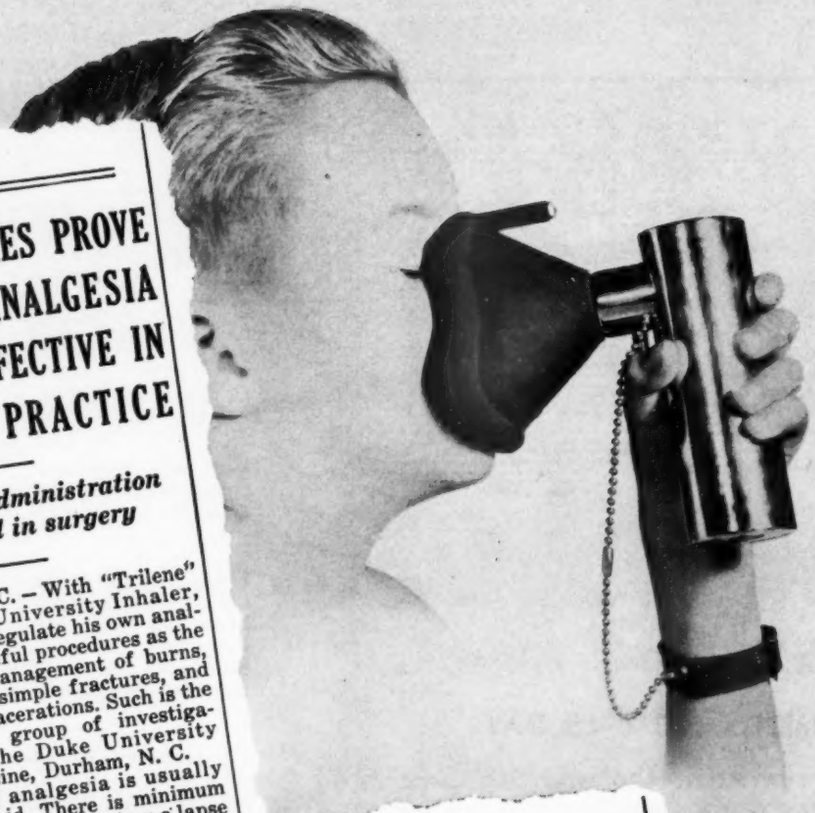

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1. Stephen, C. R., Nowill, W. K., and Martin, R.: Anesthesiology *13*:646 (Nov.) 1952.

2. Pickrell, K. L., Stephen, C. R., Broadbent, T. R., Masters, F. W., and Georgiade, N. G.: Plast. & Reconstruct. Surg. *9*:345 (Apr.) 1952.

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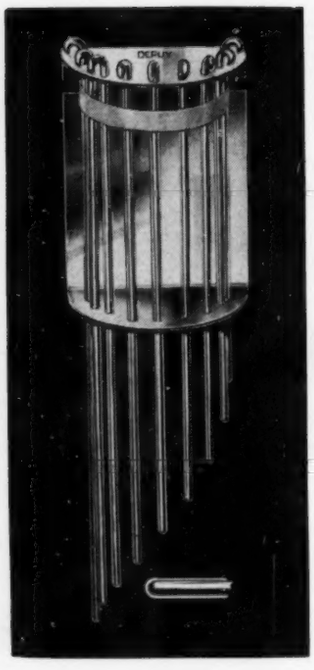

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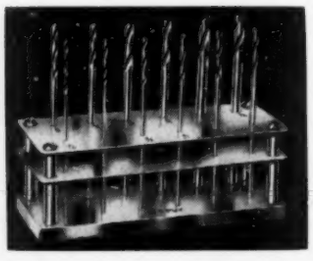

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"The Influence of The Contact-Compression Factor on Osteogenesis in Surgical Fractures" — Eggers, G.W.N., Shindler, T.O. and Pomerat, C.M.,
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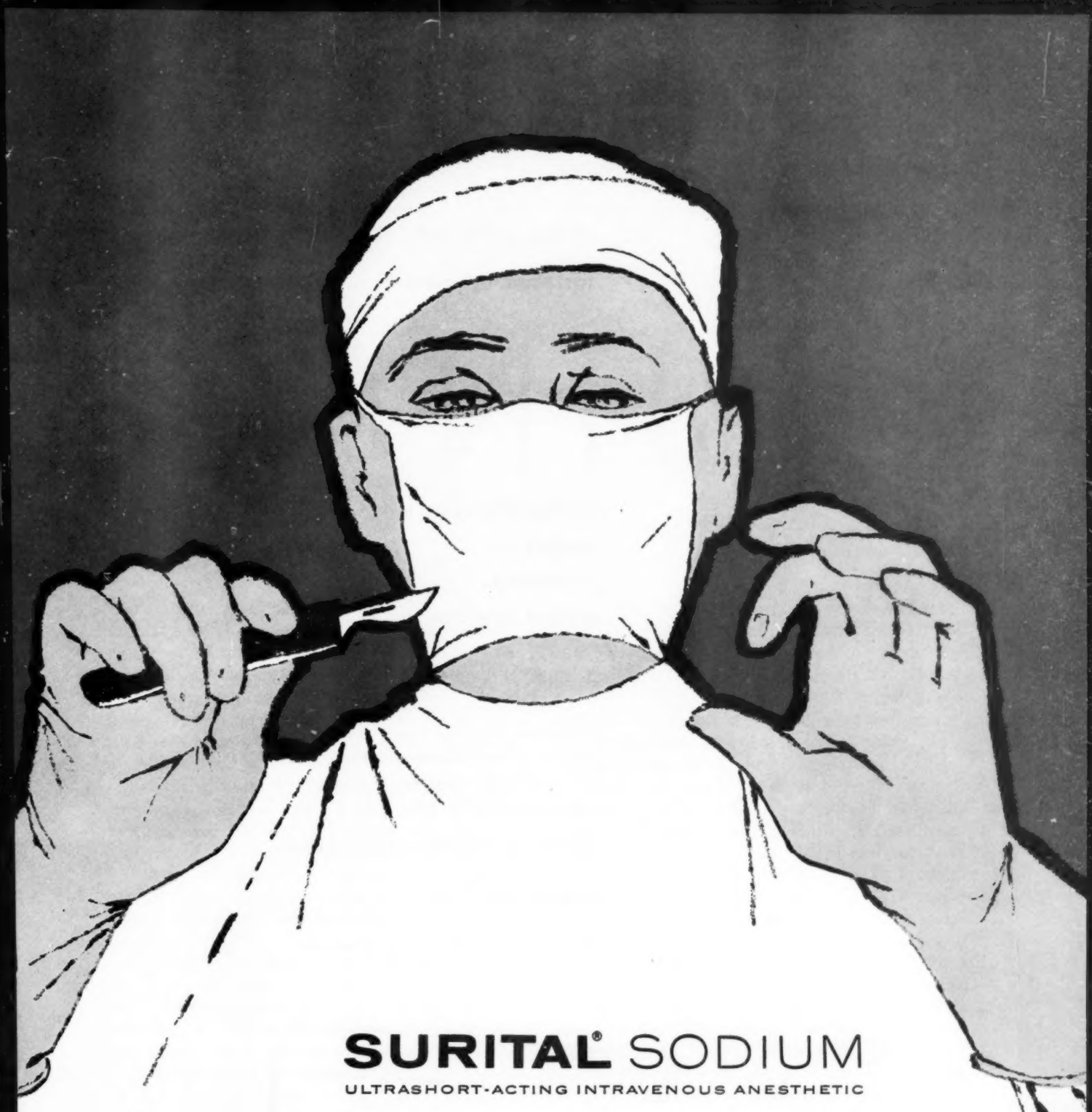

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VOL. 87 JANUARY 1954 NUMBER ONE

Editorials

1954

THE AMERICAN JOURNAL OF SURGERY begins its sixty-third year of continuous publication. Nineteen fifty-three was a banner year; there has been a healthy increase in circulation, the advertising department has had a peak twelve months and the material on hand in the editorial department is of a high order, covering a wide range.

Beginning with this issue you will note that the Journal has a "new look." The cover is new and different from the covers over the past quarter of a century. Also different are the Table of Contents and make-up of the titles of articles. During the coming year added text pages will enable us to offer more to the reader.

A publication that remains stationary will slowly die of inertia. To keep healthy, progressive and up-to-the-minute, a state of flux or a constant evolution in types of manuscripts and format must constantly go on. What was considered first class twenty years ago would be fourth rate today. Thirty years ago the truly outstanding or great names in American surgery numbered less than forty. Today they are legion. Every section of the country and most of the medical centers and large clinics have research workers, specialists and practicing surgeons of the finest caliber. Readers want and look for outstanding, authentic articles from every source and we will continue to supply that want.

In the coming year we will publish the Transactions of The American Association for the Surgery of Trauma, The American Proctologic Society and The American Society of Maxillofacial Surgeons. We are happy to announce that we will also publish the Transactions of the Pacific Coast Surgical Association, which is one of the outstanding and important organizations of the country.

New features are being added which will include reviews on a surgical topic, a sort of thumb-nail monograph, and also clinicopathologic conference reports. The first series of conferences will come from the Department of Gynecology and Obstetrics, Bellevue Hospital (N. Y.), and will be under the editorship of Drs. William E. Studdiford and Wayne H. Decker.

"Outside the Ivory Tower" is now "Notes and Quotes." It runs through the advertising pages for a reason. Here and there in it you may discover an item of interest to you, or something you may be glad to know.

The gentlemen on our Editorial Board have been of material assistance in many ways; getting us splendid material, offering sound advice, and reading and giving their opinions on submitted manuscripts. We would be lost without them.

In September with Miss Florence Wey, our Managing Editor, we flew to Springfield, Illinois, to attend the annual meeting of the American Medical Writers' Association. It was a worth while meeting and we wish more and more of our calling who write scientific papers were members. They would learn a great deal

and the result would be better articles, thereby lessening the burdens of editorial staffs of the many scientific journals. When you receive the galleys of an article you have written, compare it with your manuscript and note what has been done to and for it. At this meeting we received an outstanding honor. *The American Journal of Surgery* received the Honor Award for Distinguished Service in Medical Journalism. It is presented annually to a medical journal of the United States or Canada for accuracy, clarity and conciseness of published articles, editorials and other material. We accepted the citation and the framed plaque, which now occupies a prominent place in the Publisher's office.

As this is written our country is in a topsy-turvy state: Korea is still a mess; hospital costs will continue to rise while nurses will become scarcer and scarcer (we read that a nine-month course to develop practical nurses is advocated); the paper in this Journal costs more than double that of seven or ten years ago, and the same is true of printing and engraving expenses, hence the advance in subscription rates in all journals, lay magazines and newspapers. We pause and speculate what the world will be like a year from now. Whatever comes, we have lived through a wonderful and marvelous half-century of medicine; greater advances in all branches of medicine have been made in the past fifty years than in the last 5,000 years. We, with millions of others, believe that in the end all will be well—call it wishful thinking if you must.

And so we enter the year 1954 A.D. To our subscribers old and new and our Editorial Board members, to you one and all, may the year be one of health, peace and contentment.

T. S. W.

HUBERT A. ROYSTER, M.D.

GIVEN by former students and a graduate of the class of 1905, the accompanying illustration is a portrait of Dr. Hubert A. Royster of Raleigh, North Carolina, who was Dean of the Raleigh Division of the first four-year School of Medicine of the University of North Carolina which operated in that city from 1902 to 1910. It was presented to the University of North Carolina at Chapel Hill during the dedication ceremonies on April 23, 1953.

Dr. Royster, nationally known as a surgeon and outstanding teacher, is now retired but continues to be occupied with many medical activities. He has been a staunch friend for many years and an active member of the Editorial Board of *The American Journal of Surgery* since 1926. A gentleman in every sense of the word, a surgeon of parts and a scholar of the first water, we extend to him our most sincere wishes that his days will be those of health and happiness. T. S. W.

A Comparison of the Gibson Posterolateral and Smith-Petersen Iliofemoral Approaches to the Hip for Vitallium Mold Arthroplasty

PAUL R. LIPSCOMB, M.D., *Diplomate, American Board of Orthopedic Surgery,*
AND JOHN R. BARBER, M.D., *Rochester, Minnesota*

From the Sections of Orthopedic Surgery, Mayo Clinic and Mayo Foundation, Rochester, Minn. Read at the meeting of the American Academy of Orthopaedic Surgeons, Chicago, Ill., 1952.

THE issue concerning the best surgical approach to the hip is not new. In 1894 Kocher[7] described in detail his posterior approach which apparently was in favor for many years, then was discarded and recently again came into favor with modifications by Gibson.[5] In the third English edition of the fifth German edition of Kocher's book,[8] published in 1911, Kocher in speaking of his incision stated, "By this method the muscles supplied by the superior gluteal nerve, namely, the gluteus medius and minimus, are drawn forwards and upwards towards the tensor fasciae femoris muscle, which has the same nerve-supply, and which along with the glutei, is of special importance for the future abduction of the thigh; while the remaining muscles, the gluteus maximus, the pyriformis, and the obturators, which are mainly supplied by the inferior gluteal nerve, are drawn downwards."

On the next page of Kocher's[8] text he stated, "To obtain free access to the outer surface of the ilium and to the upper and posterior aspects of the acetabulum, Sprengel has devised an incision which is deserving of notice. . . . He carries an incision downwards from the anterior superior spine of the ilium between the anterior border of the tensor fasciae femoris and the sartorius, dividing the dense fascia lata. . . . The wound is then extended backwards along the crest of the ilium, dividing the fascia and the origins of the gluteus medius and minimus, which are stripped off the pelvis with a sharp raspatory. By turning down a flap in this manner one obtains a very good view of the hip-joint and of the margin of the acetabulum . . . . The advantage of Sprengel's incision is that the entire soft parts together with the periosteum can be raised in a single piece. . . . It is, however, a more severe operation than our posterior method."

By 1919 surgeons and authors of textbooks had altered the original Kocher incision to such an extent that the incision in the skin and plane of dissection were about 2 inches (about 5 cm.) further posterior than Kocher had described. Consequently, dissection was being carried through the mass of the gluteus maximus muscle rather than along its anterior margin. Kocher[7,8] and, more recently, Gibson stressed that the pivot point of the skin incision is the anterosuperior angle of the greater trochanter. In the Oxford Loose Leaf Surgery volume of 1918, Stiles in describing the Kocher approach stated, "The upper half of the incision . . . extends from the posterior superior angle of the greater trochanter upwards and backwards towards the posterior superior spine of the ilium. The lower half extends from the posterior superior angle of the greater trochanter downwards in the axis of the femur." Such a misunderstanding of Kocher's approach resulted in the belief that the approach was bloody, brutal and shocking.

After an experience which resulted in this belief Smith-Petersen[11] developed the anterior iliofemoral approach. The intrapelvic exposure of the acetabulum, whereby the iliopsoas and the sartorius muscles are retracted medially and both the direct and reflected heads of the rectus femoris and the tensor fasciae femoris are retracted laterally, was fully described by

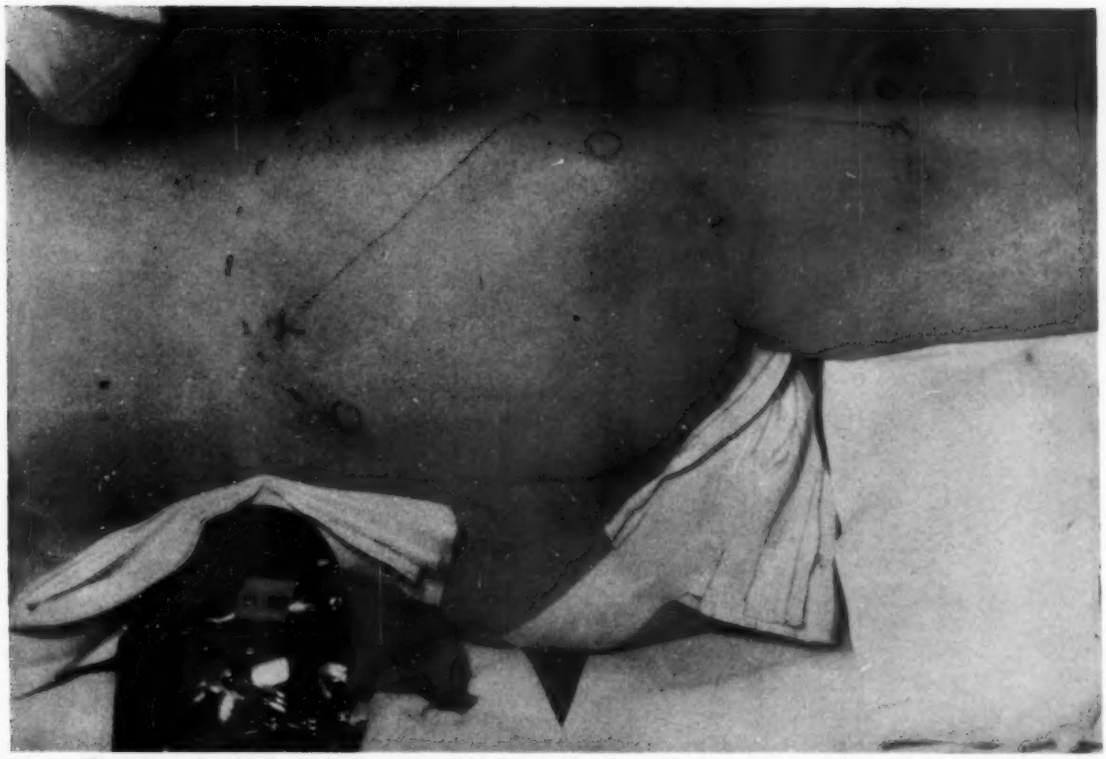

FIG. 1. Position of patient on operating table for posterolateral approach and line of skin incision. The patient lies on his sound side and is steadied in this position by kidney rests. Circles denote the anterosuperior iliac spine, the posterosuperior iliac spine and point of the greater trochanter.

Smith-Petersen in 1936.[9] In 1939[10] when he described a new method of arthroplasty of the hip whereby he introduced the Vitallium mold, and in subsequent articles Smith-Petersen and his colleagues have stressed the importance of adequate exposure if satisfactory joint function is to be restored. Campbell's Operative Orthopedics stated, "To Smith-Petersen must be given credit for improving and reviving interest in the anterior iliofemoral incision previously described by Bardenhauer, Sprengel and Langli." Gibson, likewise, must be given credit for improving and reviving interest in the so-called posterior approach to the hip joint formerly described by Kocher. The approach as revised by Gibson is more lateral than posterior and would be more correctly called the "posterolateral approach" to the hip.

Several points concerning the approach of Gibson[5,6] need re-emphasis: (1) During operation the patient lies on his sound side close to the edge of the table. (Fig. 1.) He is steadied in a lateral position by a kidney rest or sandbags in front of and behind the loin. (2) The head of the femur is dislocated in an anterior manner, just as in the iliofemoral approach, by flexion, external rotation and adduction. (3) If a severe external rotation contracture is present, the obturators, gemelli, and quadratus femoris muscles may be detached, all or in part, from the greater trochanter until the contracture is overcome. At the Mayo Clinic the joint capsule including the Y ligament is usually excised from the anterior, superior, and posterior aspects of the joint rather than incised in a cruciate manner as advocated by Gibson. We insist that the mold be fitted to the head of the femur and the thoroughly débrided acetabulum. (Fig. 2.) The postoperative care of the patient after Vitallium mold arthroplasty at the Mayo Clinic has been described by Bickel and Babb and in recent years has been essentially the same regardless of the surgical approach.

In June, 1949, one of us had the privilege of seeing Gibson perform two Vitallium mold arthroplasties through the posterolateral approach. Until this time the iliofemoral approach had been used for all Vitallium mold arthroplasties performed at the Mayo Clinic. We were so impressed by the posterolateral approach that it was decided to give it a trial at

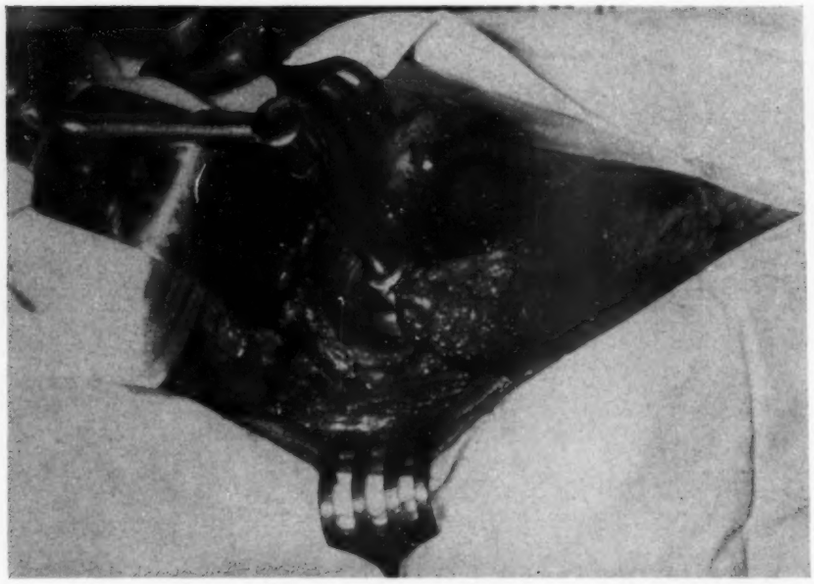

FIG. 2. The posterolateral approach to the hip gives an excellent view of the femoral head and acetabulum. These structures can be adequately débrided and fashioned as made visible, for the reception of a Vitallium mold.

the clinic. We have been so pleased with the exposure and the results obtained in cases of Vitallium mold arthroplasty that it is now used routinely for more than 95 per cent of our open operations on the hip.

ANALYSIS OF CASES

From June 23, 1949, to June 6, 1950, the posterolateral approach was employed for 100 Vitallium mold arthroplasties at the Mayo Clinic. To compare results 100 consecutive Vitallium mold arthroplasties for which the iliofemoral approach was used were studied. These operations were performed at the clinic from June 4, 1948, to October 29, 1949. Cases of ununited fracture of the hips in which a Whitman reconstruction procedure was performed together with insertion of a Vitallium mold have been eliminated from both series. The Whitman reconstruction procedure is so much easier through the posterolateral approach because of the ready accessibility of the greater trochanter that any comparison in results seems unfair.

Each type of operation was performed on ninety-four patients; six of the ninety-four patients undergoing each type of operation had bilateral operations; thus there were 100 operations in each series. The average age of patients at time of the operations which employed the posterolateral approach was 49.6 years; the youngest patient was eighteen years of age and the oldest seventy-one years. The average age of patients at the time of operations using the iliofemoral approach was 45.7 years; the youngest patient was seventeen years of age and the oldest seventy-four years. Thus the average age of patients undergoing Vitallium mold arthroplasty on the hip employing the posterolateral approach was almost four years more than that of patients in the latter series.

The average stay in the hospital per operation for patients on whom the posterolateral approach was employed was thirty-four days; the longest period of hospitalization after such operations was 149 days for a patient who had bilateral arthroplasty (this is the total for the two operations) and the shortest was nineteen days. The average stay in the hospital per operation for patients on whom the iliofemoral approach was employed was forty-one days; the longest period of hospitalization was 161 days for a patient having bilateral arthroplasty (two operations) and the shortest was eighteen days. Thus the average is one week less after the posterolateral operation.

In the analysis of the early results data concerning all operations were discarded for which follow-up study had not been possible six months or more after operation. The follow-up study consisted of examination of the patient by the operating surgeon or one of his col-

leagues and a review of roentgenograms. Follow-up study was made six months or more after seventy-eight operations for which the posterolateral approach was used. The average follow-up period after these seventy-eight operations was 10.3 months. The average follow-up study was made six months or more after seventy-seven operations for which the iliofemoral approach was used. The average follow-up period after these seventy-seven operations was 16.5 months. It is obvious that the period of follow-up in both series is of short duration. Nevertheless, the trend is clearly shown.

TABLE 1
CLINICAL RESULTS OF VITALLIUM MOLD ARTHROPLASTIES OF THE HIP

Diagnosis	Posterolateral Approach (Series 1)						Iliofemoral Approach (Series 2)					
	Operations		Results of Operation				Operations		Results of Operation			
	Total	Follow-up Adequate	Very Good	Good	Fair	Poor	Total	Follow-up Adequate	Very Good	Good	Fair	Poor
Hypertrophic arthritis	61	47	6	18	19	4	54	44	3	15	17	9
Congenital dysplasia	9	6	...	2	4	...	18	17	...	5	10	2
Avascular necrosis	18	14	1	7	4	2	15	9	...	4	4	1
Arthrokatadysis	2	2	...	1	....	1	8	5	...	....	3	2
Destructive arthritis	10	9	...	2	7	...	5	2	...	1	....	1
Total	100	78	7	30	34	7	100	77	3	25	34	15
Per cent*	...	..	9.0	38.4	43.6	9.0	...	..	4.0	32.4	44.2	19.4

* Per cent of operations after which follow-up study was adequate.

The results were classified according to the criteria previously established at our institution by [Bickel and colleagues.[1-3] The result was considered to be very good when the patient had no pain, could walk up and down stairs, tie his shoes and walk without assistance and without a noticeable limp. A good result was considered to have been obtained when the patient had little or no pain, could walk up and down stairs and could walk without assistance or with the assistance of a cane. The result was considered fair when the patient was satisfied that improvement had been obtained. Pain sometimes persisted but it was less severe than before operation and was bearable. Motion may or may not have been improved. Many patients still use a cane or a crutch. Frequently, deformity and grossly abnormal gaits were improved even though some disability persisted. A poor result was one in which the condition was not improved by the procedure and the patient was not satisfied.

Hereafter, we will refer to those operations employing the posterolateral approach as series 1 and to those employing the iliofemoral approach as series 2. In series 1 sixty-one operations were for hypertrophic arthritis, nine for congenital dislocation or dysplasia, eighteen for avascular necrosis of the femoral head, two for arthrokatadysis and ten for destructive arthritis. Included as destructive arthritis were residua from septic or rheumatoid arthritis and usually the hips were ankylosed. In series 2, fifty-four operations were performed for hypertrophic arthritis, eighteen for congenital dislocation or dysplasia, fifteen for avascular necrosis of the femoral head, eight for arthrokatadysis and five for destructive arthritis. The results of each category are given in Table 1. In series 1, seven operations produced very good results, thirty good, thirty-four fair, seven poor. The follow-up study was inadequate after twenty-two operations. In series 2, three operations gave very good results, twenty-five good, thirty-four fair, fifteen poor and in the other twenty-three the follow-up study was inadequate. Thus very good and good results followed 47.4 per cent of the operations with

FIG. 3. (*a*) Old bilateral fractures of the acetabulum with avascular necrosis and traumatic arthritis. Left hip was ankylosed. (*b*) Fifteen months after Vitallium mold arthroplasty (posterolateral approach). Fair roentgenographic result with slight varus of molds. The clinical result was good after recovery from incomplete operative sciatic palsy on the left.

adequate follow-up studies in series 1 and 36.4 per cent in series 2.

Six of the operations in series 2 which gave poor results have been followed by revision operations. One poor result now has been converted to a good result, one to a fair result and one remains poor; it is too early after the last operation to classify the other three results. Revision has been advised after six other operations in series 2 but as yet the patients have not acquiesced. No revisions have as yet been performed or advised in cases in series 1.

COMPLICATIONS

Series 1. One patient fifty-five years of age died suddenly ten days after operation from pulmonary embolism or myocardial infarction. Thrombophlebitis occurred in three patients and 1 of these had a non-fatal pulmonary embolism. Dislocation of the mold occurred after one of our earliest operations. The result of this operation was classified as poor and eventually arthrodesis was performed. In one case in which the patient had an ankylosed hip, foot drop developed immediately after operation but this cleared up in a few weeks. An incomplete sciatic palsy developed during another operation on a patient with an ankylosed hip. This operation is not included in the series because it was performed after June 6, 1950. We now make it a policy to explore the sciatic nerve before re-establishing an ankylosed hip so that the nerve can be seen and protected during the dislocation maneuver; this procedure is relatively easy and adds only a few minutes to the operation. A temporary wound infection which cleared up in a few weeks with appropriate antibiotic therapy followed one operation. One patient sustained a burn from the electrocoagulation unit which we use routinely for all operations on the hip. In one case psychosis developed during the stay in the hospital and in another the gallbladder became gangrenous four days after operation; cholecystectomy was performed. One patient had a postoperative flare-up of rheumatoid arthritis and another had ureteral colic twenty-one days after operation.

Series 2. One patient fifty-seven years of age died of lymphosarcoma thirteen months after operation. One patient had a dislocation of the hip after operation and another had an attack of gout which slowed his convalescence. One youth, eighteen years old, had mumps soon after going home and was told not to move his hip because of the danger of an orchitis. The hip quickly tightened up and later a revision was required.

Comment. It is our opinion that most of these complications cannot be blamed on the method of approach or the exposure. For some unexplained reason in 1949 and 1950 we had seven deaths on the orthopedic service from pulmonary embolism and only two deaths in 1947 and 1948 from the same cause.

FIG. 4. (*a*) Osteoarthritis of left hip secondary to old septic arthritis; (*b*) appearance of left hip one year after Vitallium mold arthroplasty (posterolateral approach). The mold is in excellent position and there is an absence of the preoperative osteophytes.

ANALYSIS OF ROENTGENOGRAMS

The preoperative roentgenograms and roentgenograms made six months or longer after operation were reviewed and compared. At the time this was done we did not know whether a posterolateral or an iliofemoral approach had been used nor did we know the clinical result of the operation. In evaluating the roentgenograms we took into account the appearance before operation, in other words, what material the surgeon had to work with, the apparent fit of the mold on the femoral head and in the acetabulum, the position of the mold (was it in varus?), the postoperative absence of preoperative acetabular overgrowth and the presence or absence of myositis ossificans. (Figs. 3 and 4.) The results of this analysis are tabulated in Table II. It can be seen that in series 1 the postoperative roentgenograms were classified as good in forty-nine (62.8 per cent) and in series 2, forty-six (59.7 per cent). They were classified as fair in twenty-five cases (32 per cent) in series 1 and in twenty-two cases (28.6 per cent) in series 2. The roentgenographic results were poor in four cases (5.1 per cent) in series 1 and in nine cases (11.7 per cent) in series 2. From these figures, it appears that the mechanical appearance as determined by roentgenograms of the hip having a mold arthroplasty is apt to be slightly better if a posterolateral approach is used. It should be noted that the clinical and roentgenographic results did not coincide. Many patients in both series with good postoperative results as depicted in roentgenograms had fair or poor clinical results. Likewise, some patients with only fair postoperative results as seen in roentgenograms had excellent or good clinical results.

OBSERVATIONS

As claimed by Gibson[5] we have found that the posterolateral approach to the hip joint is simple, thorough and extensible to any degree. The posterolateral approach is accompanied by less bleeding and less trauma than the iliofemoral approach. In the former approach muscles are detached from their insertions rather than from their origins and there is less shortening of muscle fibers. Interference with the function of the iliotibial tract is minimal. The capsule of the hip can be more thoroughly excised and contractures overcome by releasing the soft tissues rather than by removing excessive bone from the head of the femur or the acetabulum. The femoral head is made visible much more easily through the posterolateral approach and the acetabulum just as easily and in most instances more easily than through the iliofemoral approach. Consequently, these structures together with the Vitallium mold can be better fashioned and fitted through the posterolateral approach. Less time is required for the same job through the posterolateral approach.

One disadvantage of the posterolateral approach is the position of the patient on the operating table. This makes anesthesia slightly

more difficult and hazardous. If a cast is required the position of the patient must be changed before the plaster can be applied; this procedure is difficult in heavy patients and fraught with danger as far as maintenance of position of the operated hip is concerned.

operation is postponed. There are too many patients forty to fifty years of age or less who have bilateral disease of the hips which is progressive who are being advised to get along as best they can until the condition becomes unbearable and then have a reconstructive

TABLE II

ROENTGENOGRAPHIC RESULTS OF VITALLIUM MOLD ARTHROPLASTIES OF THE HIP

Diagnosis	Posterolateral Approach (Series 1)				Iliofemoral Approach (Series 2)			
	Follow-up Adequate	Results			Follow-up Adequate	Results		
		Good	Fair	Poor		Good	Fair	Poor
Hypertrophic arthritis	47	26	17	4	44	24	16	4
Congenital dysplasia	6	5	1	...	17	9	5	3
Avascular necrosis	14	10	4	...	9	9	....	....
Arthrokatadysis	2	2	....	...	5	3	....	2
Destructive arthritis	9	6	3	...	2	1	1	....
Total	78	49	25	4	77	46	22	9
Per cent	..	62.8	32.1	5.1	..	59.7	28.6	11.7

We have noticed that our patients are more comfortable, their convalescence faster, their morbidity less and stay in the hospital shorter when Vitallium mold arthroplasties are performed through the posterolateral approach. As a result of all of these factors the clinical and roentgenographic results are better in cases of Vitallium mold arthroplasty of the hip performed through the posterolateral surgical approach.

At this point we would like to stress the importance of muscle function and its relationship to the clinical result. Regardless of the excellence of the operative procedure and the appearance in the roentgenograms, the clinical result in cases of Vitallium mold arthroplasty of the hip will be poor unless the patient maintains or develops good muscle power. We firmly believe that patients showing evidence of progressive degenerative disease of the hip should have reconstructive surgical procedures in the form of mold arthroplasty early. (Fig. 5.) If the operation can be performed before marked muscle atrophy, secondary contractures and unfavorable walking habits develop, convalescence is quicker and easier and in most instances the final result far better than when operation. We have had several patients who have had severe fracture dislocations of the hips who, we thought, were bound to have severe trouble at a later date as a result of their injury. In these patients a Vitallium mold was inserted soon after the original surgery. One operation on such a patient with posterior dislocation of the hip together with a fracture of the femoral head is included in series 1 of this paper. This patient was operated on a few hours after the original injury and at this time the loose fragment of the femoral head was removed, the cartilage was reamed from the remaining femoral head and a Vitallium mold was inserted at the time of reduction. The early clinical result was excellent and has been maintained for two and a half years.

CONCLUSIONS

1. The posterolateral approach to the hip is simpler and less traumatic than the iliofemoral approach.

2. The posterolateral approach gives a better exposure of the hip.

3. Contractures, especially external rotation contractures, can be overcome through the

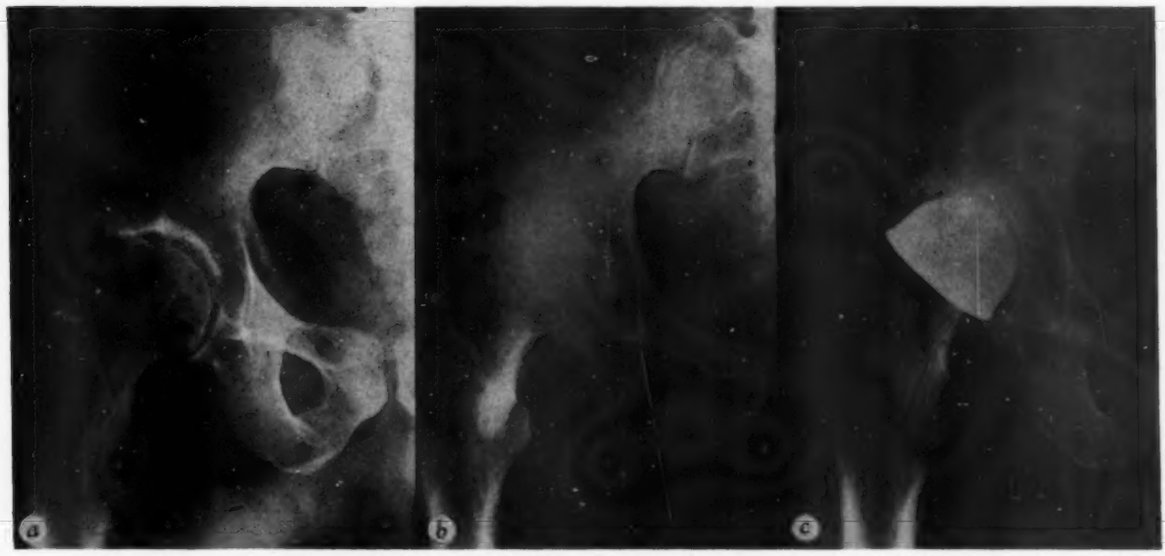

FIG. 5. (*a*) Early osteoarthritis of right hip following mild slipped upper femoral epiphysis; patient was forty-nine years of age. (*b*) Same hip eleven years later; patient was sixty years of age; note marked increase in degenerative changes. (*c*) Same hip one year after Vitallium mold arthroplasty (iliofemoral approach); note myositis ossificans. A fair clinical result was obtained; a better one might have been obtained had the patient been operated upon several years sooner.

posterolateral approach without removing excessive bone.

4. Convalescence is more rapid and the stay in the hospital shorter in cases in which the posterolateral approach is used for Vitallium mold arthroplasty than in those in which the iliofemoral approach is used.

5. The early clinical and roentgenographic results are better in cases in which Vitallium mold arthroplasty is performed through the posterolateral approach than they are in cases in which the operation is performed through the iliofemoral approach.

6. Middle-aged and young patients with progressive degenerative disease of the hips should be treated with Vitallium mold arthroplasty before marked muscle atrophy, contractures and bad walking habits occur.

SUMMARY

The history of the development of two surgical approaches to the hip joint is briefly reviewed. Results of 200 Vitallium mold arthroplasties, for half of which the posterolateral approach of Gibson was used and for half the iliofemoral approach of Smith-Petersen, have been critically analyzed and compared; all patients were operated on during a two-year period (June 4, 1948, to June 6, 1950).

This paper has not been presented to take away any of the credit due Smith-Petersen who developed and taught us the principles of arthroplasty of the hip. We will ever be indebted to him for the development of the Vitallium mold and indeed for all his contributions to surgery of the hip and orthopedic surgery in general. There are often many ways of reaching the same end. At present we believe that for most open operations on the hip the posterolateral approach of Gibson is superior to the iliofemoral approach. Certainly all orthopedic surgeons should be well versed in both.

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WE have learned that any gastric ulcer—situated anywhere in the stomach—may sooner or later become malignant. Cases of short duration, in patients over fifty years of age, are often gastric carcinomas that have become partially digested by the gastric juices and now have an ulcer crater; the more chronic cases were probably benign ulcers at first and only later became malignant if at all. This occurs in at least 20 per cent. Early cases are usually treated by medical means but periodic x-ray series must be taken to see if the ulcer is healing. If not it may be malignant. Even when apparently healing it may be malignant because the crater may temporarily fill up with cancerous tissue and be misleading, giving the practitioner a false sense of security. The safe rule is to consider all gastric ulcers as malignant unless proven otherwise; and if medical therapy is unsuccessful (according to x-ray and gastroscopic evidence) and the "ulcer crater" persists or enlarges, subtotal gastrectomy should surely be performed. (*Richard A. Leonardo, M.D.*)

Treatment of Carcinoma of the Colon and Rectum

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IN the light of our present knowledge surgical resection remains the only treatment for carcinoma of the colon and rectum. In many respects surgical treatment of carcinoma of the colon and rectum today shows considerable progress over that which was employed just a few years ago. Increasing experience, the use of the non-absorbable sulfonamide drugs such as sulfathalidine, sulfasuxidine and the antibiotics such as streptomycin, aureomycin and neomycin, the more extensive use of blood replacement and the increased appreciation of the need for careful mechanical preparation of the bowel before operation are factors in this improvement. One of the most striking changes has been the steadily increasing use of the one-stage procedure for resection of carcinoma of the colon and rectum. This has increased to the point where there is some danger that young surgeons receiving their training today will be unfamiliar with anything except the single stage operative procedure for the resection of malignant disease of the large intestine.

The choice of operative procedure for patients with carcinoma of the colon and rectum must always be individualized. There will still be patients who come to operation with an obstructed, dilated, proximal segment. A two-stage resection should always be seriously considered in this situation. This clinic has long been known for its extensive experience with the modified Mikulicz procedure for resection of carcinoma of the colon. This type of resection was devised and developed to meet a real need in the treatment of cancer of the large bowel. The mortality in the early days of resection with primary anastomoses for cancer of the colon ranged from 10 to 25 per cent. The principal cause of death was from generalized peritonitis secondary to a leak at the suture line. The Mikulicz procedure eliminated this source of contamination and the risk of peritonitis was greatly reduced. Our experience with several hundred cases demonstrated to our satisfaction that the modified Mikulicz procedure could be made just as radical in its scope as resection with intra-abdominal anastomosis.[3] It also demonstrated that this operative procedure, originally used for carcinoma of the left colon, could be applied equally well to carcinoma of the right colon by the formation of a double-barreled spur, using the terminal ileum and transverse colon.[4] The possibility of implantation of cancer in the operative incision associated with the original Mikulicz procedure was eliminated by a wide removal of the growth, adjacent bowel and mesentery before the spur was constructed. We have always believed that when a two-stage procedure was indicated, the modified Mikulicz procedure had an advantage over other two-stage procedures in that the growth was eliminated at the time of the first operation and the second stage was an extraperitoneal procedure. The modified Mikulicz procedure is particularly adaptable to the unfavorable case and its use should be considered seriously whenever the operative conditions make primary anastomosis unduly hazardous.

The general trend toward the increased use of a one-stage procedure has been reflected in our experience. In 1940 all patients at the clinic with cancer of the colon had a modified type of Mikulicz resection performed. In 1945 80 per cent had a Mikulicz type of resection and 20 per cent had a resection with primary anastomoses. In 1949 seventy-one of seventy-two patients with cancer of the colon had a one-stage resection with primary anastomosis and only one patient had a resection by the modified Mikulicz procedure. (Table 1.)

In spite of all that has been said and written regarding the early signs and symptoms of car-

cinoma of the colon and rectum, patients are still seen in whom the lesions have progressed to the point of causing marked degrees of obstruction. It should be added that in 1949 four patients who subsequently had a primary resection with anastomoses required preliminary decompression either by cecostomy or transverse colostomy because of almost complete obstruction.

TABLE 1
OPERATIVE PROCEDURE
RESECTION FOR CARCINOMA OF COLON

Year	Modified Mikulicz		Primary Anastomosis	
	Cases	Per cent	Cases	Per cent
1940	19	100	0	0
1945	36	80	9	20
1949	1	1.4	71	98.6

The use of sulfathalidine and sulfasuxidine along with the antiobiotics such as streptomycin, aureomycin and neomycin has permitted a steadily increasing use of the open type of anastomosis. It is generally agreed today that with a well prepared colon, the incidence of significant peritonitis is not increased by the open type of anastomosis over the so-called aseptic type of suture. We have always believed that complete visualization of the mucosal, submucosal and serosal layers permitted more accurate placement of sutures and resulted in a strong accurate union with less inversion and less chance for postoperative obstruction.

In recent years there also has been a markedly increased interest in operative procedures designed to eliminate the need for a permanent colostomy which is an integral part of the abdominoperineal or Miles resection for carcinoma of the rectum. In the last few years some definite evidence has been provided regarding the limitations of these other procedures. On the other hand increased experience and adequate blood replacement have demonstrated that resection of the uterus, vagina, portions of the bladder, prostate and other adjacent structures which may be invaded by a carcinoma of the rectum or rectosigmoid is not only feasible but also may result in a permanent cure.

CARCINOMA OF THE RIGHT COLON

Preparation. Since most patients with carcinoma of the colon and rectum are in the older age group their cardiac and renal status should be carefully evaluated before operation is performed. Many patients with carcinoma of the cecum or ascending colon have a profound anemia. In some instances it may be the only symptom of their malignant disease. The hemoglobin, red blood count and blood volume should be restored to normal before operation. Transfusions of whole blood also constitute the most satisfactory means of restoring the low serum protein levels so frequently found in patients with malignant disease of the colon. Restoration of serum protein to normal and near normal is important in the prevention of edema at the site of the anastomosis following resection.

Much has been written regarding the importance of the antibiotics in the preparation of the bowel of patients with carcinoma of the colon. As valuable as the antibiotics and sulfon derivatives are as adjuncts in preparing these patients, nothing can take the place of a careful mechanical preparation of the colon before operation. Before mechanical cleansing is started, these patients should be carefully examined for the presence or absence of obstruction. Although obstruction is not as common in patients with carcinoma of the right colon as it is in patients with carcinoma of the descending colon or sigmoid, it does occur and constricting lesions of the hepatic flexure or ascending colon, or malignant disease involving the ileocecal valve may produce a marked degree of obstruction to the ascending colon, cecum or to the small bowel. If the small bowel is obstructed, it should be decompressed immediately by a Miller-Abbott, Harris or similar tube. If there is marked distention of the cecum or ascending colon, cecostomy may have to be seriously considered. If the ileocecal valve remains competent, a closed loop is produced. The distention of the cecum may be marked and perforation may occur. If obstruction is not present, these patients are given 1½ ounces of magnesium sulfate on admission. Colonic irrigations are performed twice a day to empty the colon from below. Administration of sulfathalidine, 2 gm. every four hours, should

be started immediately and forty-eight hours before the operative procedure streptomycin, 1 gm., twice a day should be given. Recently, we have used neomycin (1 gm. every four hours) in place of streptomycin. Its advantage over streptomycin is that it appears to avoid the development or overgrowth of resistant bacterial variants. For this reason neomycin may be given from the beginning with the sulfathalidine. All patients with carcinoma of the right colon, whether or not obstruction is present, are intubated with a Miller-Abbott, Harris or similar tube before operation is performed. These patients will have an anastomosis between the terminal ileum and transverse colon and an indwelling intestinal tube permits the area of the anastomosis to be kept decompressed until the passage of flatus by rectum, the presence of peristalsis and the absence of distention indicate that the anastomosis is functioning normally.

Operation. The technic of primary resection of the colon has been reviewed in detail[2] and only the fundamental surgical principles involved will be repeated at this time. Spinal anesthesia is used routinely for all patients with carcinoma of the rectum and colon. A vertical incision, either right rectus or paramedian, is made. It should be of sufficient length to permit adequate exposure of the entire operative field. Careful exploration of the abdominal cavity is then carried out to determine the presence or absence of metastases and to rule out a second primary lesion elsewhere in the colon. In our experience 4 per cent of the patients with carcinoma of the colon or rectum have a second primary malignancy present in another segment of the colon or rectum. If hepatic metastases are present, a palliative resection is preferable to an ileotransverse colostomy, unless the lesion is so extensive or the patient's condition so precarious as to make resection inadvisable. In the absence of distant metastases local fixation of these large growths in the right colon to the lateral or anterior abdominal wall should not be considered evidence of inoperability. Many malignant growths of the right colon invade the surrounding structures before metastasis occurs. Complete mobilization of the right colon and terminal ileum down to the origin of the ileocolic and right colic arteries is the first important step in the procedure. This will permit wide resection of the growth and adjacent bowel on either side, along with removal of the mesentery of the entire right colon and the mesentery of the terminal ileum. In patients with carcinoma of the hepatic flexure or right half of the transverse colon the ascending colon, cecum and terminal ileum should be resected since it has been shown that neoplasms of the hepatic flexure often metastasize to lymph nodes along the ileocolic artery. The terminal ileum and mid-transverse colon are united by an end-to-end, end-to-side or side-to-side anastomosis. I prefer an end-to-end anastomosis since it involves but one suture line and does not leave a blind pouch of colon or ileum. The mesentery is then carefully closed to prevent herniation of small bowel and the right gutter is peritonized to minimize the possibility of postoperative obstruction. One or two transfusions are usually given during the operative procedure. A total of 100,000 units of penicillin is placed in the peritoneal cavity and the wound is closed in layers or by far and near wire sutures inserted through the fascia, muscle and peritoneum. The Miller-Abbott tube is placed on suction and removed when the presence of peristalsis and the passage of gas by rectum indicate that it is no longer necessary. The patients are allowed out of bed after the first forty-eight hours and their average stay in the hospital at the present time is about ten days.

CARCINOMA OF THE LEFT COLON

Preparation. Any cardiac or renal impairment is evaluated and any existing anemia corrected. Anemia in patients with carcinoma of the left colon usually indicates an advanced lesion and possibly hepatic metastases. It has a far more serious prognostic significance than does anemia in patients with carcinoma of the right colon. The preparation of the bowel is similar to that carried out for patients with carcinoma of the right colon, except that a malignant lesion of the left colon is more frequently associated with significant degrees of obstruction and in these patients preliminary cecostomy or transverse colostomy must be seriously considered if the degree of obstruction is marked.

Procedure. Adequate mobilization of the left colon, including the splenic flexure, is an essential part of the operative procedure. It permits an adequate cancer operation in that the lesion can be removed with a wide segment

of adjacent bowel on either side plus all of the adjacent mesentery down to the origin of the middle colic and left colic arteries. In many patients with carcinoma of the splenic flexure the fatty tissue surrounding the left kidney is involved and should be removed with the lesion. A palliative resection with anastomosis is preferable to any side-tracking procedure unless it would be unduly hazardous for the patient. Adequate mobilization also enables the anastomosis to be made between the two loops of colon without tension on the suture line. Tension on the suture line invites leakage and peritonitis. Mobilization and identification of the main colic vessels at the root of the mesentery not only permit adequate resection of any metastatic spread of the malignant disease but also are helpful in identifying and preserving a good blood supply to the remaining segments. In addition to preserving a branch of one of the main colic arteries, the surgeon must be certain that pulsation can be seen or felt in vessels supplying the cut margins of the proximal and distal colon which are to form the anastomosis.

For an adequate cancer operation in cases of carcinoma of the mid or low sigmoid regions, all of the sigmoidal mesentery below the origin of the left colic artery including all of the remaining inferior mesenteric artery must be removed. For a lesion in this location, any operative procedure, either Mikulicz or primary resection with anastomosis in which the continuation of the inferior mesenteric artery (superior hemorrhoidal) is preserved, must be considered an inadequate cancer operation. The anastomosis is made by an end-to-end suture. It should be kept in mind that the caliber of the colon on the left side is appreciably smaller than that on the right side and if there is excessive inversion of the suture line postoperative obstruction is likely to occur. For this reason, two rows of small interrupted silk sutures are preferable, the first row passing through all coats of bowel wall on each side. This includes the tough submucosa and gives strength to the anastomosis. The second row of interrupted seromuscular sutures approximates the serosa and an airtight and watertight anastomosis will be produced without excessive inversion. The mesentery is closed and the left gutter is peritonized. In lesions of the splenic flexure care must be taken not to narrow the jejunum at the ligament of Treitz during the closure of the mesenteric aperture. The Miller-Abbott tube is not used routinely in patients with carcinoma of the left colon. It decompresses the small bowel but it cannot be depended upon to decompress the area of the anastomosis unless the ileocecal valve happens to be patent.

CARCINOMA OF THE RECTUM AND RECTOSIGMOID

Preparation. The preparation of the patient and of the colon is carried out as already described. The likelihood of obstruction is appreciably less for lesions in this locaton. Moreover, mild degrees of obstruction are less important when an abdominoperineal resection is contemplated since the colostomy can be decompressed at the end of the operative procedure.

Procedure. Much has been written in recent years regarding operative procedures designed to eliminate the need for a permanent colostomy which is a part of the Miles abdominoperineal resection, in lesions of the rectum and rectosigmoid. Whatever procedure is carried out it must constitute an adequate cancer operation for the particular lesion involved. Lahey has pointed out that a small growth and the absence of palpable nodes should not tempt the surgeon to adopt a less radical procedure, for it is in this type of case that radical surgery offers the greatest opportunity for a permanent cure. We have always believed that the abdominoperineal resection as described by Miles was the most radical operation that could be carried out for carcinoma of the rectum and rectosigmoid.[3] It was in an effort to reduce the mortality associated with the early use of this radical procedure and also to increase the number of cases in which the growth could be resected that Lahey devised the two-stage abdominoperineal resection which bears his name.[5] A left rectus colostomy was established at the first operation. This was followed by irrigations of the distal non-functioning loop which had been implanted in the suprapubic region. At the time of the second operative procedure, two to three weeks later, the extensive inflammatory reaction, so frequently associated with large and at times perforated lesions of the rectum, had largely subsided. In many patients in whom the lesion was considered (at the clinic or elsewhere) to be inoperable at the time of the first operative procedure, it proved to be resectable at the second stage.

The same factors that played a part in reducing the need for a two-stage resection in cancer of the colon have also led to an increasing use of the one-stage resection for cancer of the rectum and rectosigmoid. Increasing experience, more adequate blood replacement and careful preoperative preparation of the rectum and distal colon have steadily reduced the need for the two-stage Lahey resection. In 1940 eighteen patients or 41.8 per cent of all patients with carcinoma of the rectum and rectosigmoid were operated on by the two-stage Lahey resection. Twenty-five patients were submitted to a Miles abdominoperineal resection. In 1945 eighty-nine patients had a one-stage abdominoperineal resection and only one patient had a two-stage Lahey resection. In 1949, again, only one patient was submitted to a two-stage procedure. (Table II.)

Reports which have appeared in the surgical literature of the last five years advocating procedures other than the Miles abdominoperineal resection deal mostly with the posterior resection or so-called pull-through operation as advocated by Babcock and Bacon, and the anterior resection with an intra-abdominal anastomosis of the upper sigmoid or descending colon with the rectal stump. The latter procedure has been much more widely employed and has an advantage in that the patient retains normal sphincteric control in addition to avoiding a permanent colostomy. The important question that arises when one of these procedures is considered is whether or not it constitutes an adequate cancer operation for the particular rectal or rectosigmoid lesion. At the present time there is considerable difference of opinion among surgeons regarding this point. The final answer must wait until time permits the comparison of five-year survival rates of a sufficiently large number of patients following anterior resection with those following the Miles abdominoperineal resection. Certain facts, however, are already becoming apparent. It is generally agreed today that a margin of 2 to 3 cm., as originally suggested, between the lower palpable border of the lesion and the line of resection is not sufficient; and if local recurrence is to be avoided, the line of resection should be at least 7.5 cm. below the lower palpable border of the lesion. The original margin was suggested on the basis of studies which indicated that the mode of spread of the malignant lesion is always upward along the inferior mesenteric artery. We now know if this main mode of spread is blocked, the carcinoma may spread laterally or even downward for a considerable distance.

The local recurrence rate following anterior resection for any lesion at or below the peritoneal reflection is appreciably higher than that following the Miles abdominoperineal resection. We have never carried out a curative anterior resection for carcinoma at or below the peritoneal reflection and believe that the Miles abdominoperineal resection should be the operative procedure for all cancers in this location. Even if a palliative resection is carried out for a lesion at or below the peritoneal reflection, as for example in a patient with hepatic metastases, it is doubtful whether any procedure other than an abdominoperineal resection should be considered. These advanced lesions usually are large and adherent and may recur locally. When local recurrence takes place following an anterior resection, a second operative procedure probably will be necessary to relieve obstruction. Local recurrence of a rectal carcinoma following resection is a very distressing condition. It is usually associated with severe pain and discomfort, and may require bilateral chordotomy for relief. The best chance the surgeon has to prevent this unfortunate development is to carry out the widest possible removal of the growth at the time of the first operative procedure.

In addition to its use in patients with carcinoma of the mid and low sigmoid colon, it may be that anterior resection has a place in the treatment of carcinoma of the rectosigmoid or that portion of the pelvic colon which lies above the peritoneal reflection. If an anterior

TABLE II

OPERATIVE PROCEDURE

RESECTION FOR CARCINOMA OF RECTUM AND RECTOSIGMOID

Year	Lahey	Miles	Anterior Resection (with Anastomosis)
1940	18 (41.8%)	25 (58.2%)	0
1945	1	89	0
1949	1*	101	8 (7 palliative, 1 curative)

* Died following first stage procedure.

resection comparable in extent to the abdominoperineal resection is to be carried out, not only should the bowel be divided at least 2½ to 3 inches (6 to 9 cm.) below the lower border of the lesion but also the inferior mesenteric artery along which carcinoma of the rectum has its main mode of spread should be divided at a level at least as high as in the Miles abdominoperineal resection. This means it should be divided well above the bifurcation of the aorta and preferably close to the origin of the inferior mesenteric artery, saving only the left colic artery. If there is evidence of involvement of the lymph nodes up to the origin of these vessels, the inferior mesenteric artery should be ligated as it arises from the aorta and a left colectomy carried out along with the abdominoperineal resection. The splenic flexure having been mobilized, a colostomy can be formed from the distal transverse colon which will be nourished by the branches of the middle colic artery. This also permits removal of any involved lymph nodes along the aorta below the superior mesenteric artery.

Following an anterior resection for carcinoma of the sigmoid and rectosigmoid, we usually do not carry out a complementary cecostomy or transverse colostomy. The pelvis is always drained. Following an abdominoperineal resection, the pelvic peritoneal diaphragm is made as relaxed as possible so that the weight of the small bowel will accelerate the obliteration of the dead space in the pelvic cavity. The posterior perineal wound is drained and closed in layers.[1] These two factors permit many of these patients to have a dry perineal wound by the time they are ready for discharge from the hospital.

TABLE III
CARCINOMA OF THE COLON

Year	Mortality (%)	Operability (%)
1940	10.5	82.8
1945	2.4	86.5
1949	2.8	88.4

TABLE IV
CARCINOMA OF RECTUM AND RECTOSIGMOID

Year	Mortality (%)	Operability (%)
1940	16.5	89.2
1945	7.8	81.4
1949	2.3	96.4

COMMENT

It is important to realize that this change to a one-stage resection for carcinoma of the colon and rectum is desirable only if it can be demonstrated that it is not accompanied by any increase in the mortality rate. As long as there is any mortality associated with a one-stage resection of the colon, particularly if that mortality is due to intraperitoneal sepsis, the possibility that that patient might have been saved by a two-stage operative procedure such as a modified Mikulicz resection must be considered. Our mortality rate not only has not increased, but also, as in most surgical centers which are interested in carcinoma of the colon and rectum, it is appreciably less than it was ten years ago. The mortality for carcinoma of the colon was 10.5 per cent in 1940, 2.4 per cent in 1945 and 2.8 per cent in 1949. For carcinoma of the rectum it was 16.5 per cent in 1940, 7.8 per cent in 1945 and 2.3 per cent in 1949. (Tables III and IV.) Mortality rates cannot be fully evaluated unless the corresponding operability rates also are known. In other words, is the lowered mortality rate due to the fact that more cases in which the lesions were extensive were considered inoperable in 1949 than in 1940? That this was not the case is shown by the operability rates for patients with carcinoma of the colon which were 82.8 per cent in 1940, 86.5 per cent in 1945 and 88.4 per cent in 1949. (Table III.) In patients with carcinoma of the rectum and rectosigmoid the operability rate in 1940 was 89.2 per cent, in 1945 was 81.4 per cent and in 1949 was 96.4 per cent. (Table IV.) The operability rate of 96.4 per cent in 1949 for patients with carcinoma of the rectum is the result of our belief that resection of the growth is well worth while in every patient with carcinoma of the rectum in whom it is technically possible to remove the lesion. A colostomy will relieve obstruction in a patient with a far advanced carcinoma of the rectum but his remaining life is likely to be most unpleasant if the rectal lesion is not removed. These patients all have severe perineal pain and

rectal tenesmus aggravated by the constant discharge of blood and mucus.

CONCLUSION

The morbidity, particularly the length of hospital stay, associated with the present day treatment of carcinoma of the colon and rectum has been markedly reduced. An operability rate that has risen to approximately 90 per cent and a mortality rate that has dropped to less than 3 per cent are indicative of the progress that has been made in the treatment of this condition. These figures also suggest, however, that any further significant improvement in the end results of the treatment of cancer of the colon and rectum must come from earlier diagnosis and the detection and elimination of the premalignant mucosal polyp.

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In spite of antibiotics and even of two-stage operation excision of an esophageal diverticulum may lead to fatal mediastinitis. Surgeons in Europe have recently favored simple inversion of the diverticulum with adequate repairs of the esophageal wall at its base. The average diverticulum becomes quite small after the overlying fascia has been separated so its inversion does not cause dysphagia. When done under local anesthesia with the Levin tube *in situ*, the patient retains his swallowing reflex and this facilitates identification and dissection of the diverticular sac. (*Richard A. Leonardo, M.D.*)

Cancer of the Pancreas

A PLEA FOR TOTAL PANCREATECTOMY

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CANCER of the pancreatic area is a challenge to the modern surgeon. Operative mortality in the first ten years of this radical surgery was over 30 per cent.[43] With increased knowledge and experience this has been steadily lowered. Cattell,[9] who now has performed over ninety-one cases, has steadily reduced his mortality. Waugh[38] has lost only one patient in his last fifteen cases. Parsons and Lockwood[24] did not lose a case in their last thirteen. The author has had an experience of nineteen cases. In his last nine operations there was only one surgical mortality although four patients underwent radical total pancreatectomies.

Whipple, Parsons and Mullins[40] demonstrated that the radical operation is practical in man. Since their report in 1935 the operation has been modified by Whipple and many others.

The long-range viewpoint, however, has been discouraging. Very few patients have survived the arbitrary five-year period. Cattell[9] reported that 30 per cent of his patients lived over three years. Miller,[27] reporting from the Mayo Clinic, stated that three of twenty-nine patients were alive after five years. Rhoads, Howard and Moss[32] stated, "Results of survival have been disappointing and necessitate either modification of the operative procedure or abandonment of the operation."

We believe that progress can be made and that the time is ripe for complete re-evaluation. There are two main issues: (1) earlier diagnosis and (2) a radical extension and change in the operative technic.

DIAGNOSIS

This subject has been dealt with adequately by many authors[5,12,23,33] so that only a summary will be given here.

1. The "consciousness" of cancer in this area must be instilled into the physician's mind.

2. The patient usually presents himself at least six months prior to the onset of jaundice. He complains usually of ill defined distress in the upper abdomen with atypical indigestion and often anorexia. Cramping and diarrhea are present in some cases.

3. Pain is present in 66 per cent or more of cancers of the head of the pancreas and 40 per cent of the ampulla.[36] It may be severe and boring in nature. Occasionally it is reflected to the back and may be centered over the second lumbar vertebra. The pain is often lessened by bending forward. It may also appear chiefly at night.

4. X-ray studies are usually performed early but deformity of the duodenum is often overlooked since the cancers are small. In the large cancers, often marked deformity is noticed in the duodenum or pylorus. Poppel[31] describes the various deformities very adequately. Too often the x-ray diagnosis is reported as negative, especially in early cases.

5. Loss of weight may be a prominent sign and varies from 10 pounds to over 50 pounds. If symptoms continue, certainly cancer of the pancreas should be considered and further studies should be made.

6. Laboratory studies: Duodenal drainage performed by the Lagerlof[22] technic should yield a rapid, sudden increase in enzyme content if the pancreatic ducts are open. Secretin is used as a stimulant. Bauman[2] uses mecholyl and believes it is better than secretin. The results show abnormality or even absence of enzymes in over 90 per cent of cases in which cancer is in the head of the pancreas. Blood cells are almost diagnostic of cancer, particularly in cancer of the ampulla. McNeer and Ewing[26] found cancer cells in duodenal drainage.

Stool examination may reveal occult blood and may show a high fat content and undigested muscle fibers.

Blood lipase was found by Comfort[12] to be elevated in 67 per cent of cases of cancer of the ampulla and 40.5 per cent in cancers of the head. Amylase determinations seem to be unreliable.

7. General examination usually shows some enlargement of the liver. This is most significant and suggestive, especially when the spleen is small. If, also, a dilated gallbladder is found, cancer of the pancreas should be seriously considered.

8. Jaundice is an early symptom in cancer of the ampulla and occurs in nearly 100 per cent of these cases. In cancer of the head of the pancreas it is a late symptom and may even be absent if the cancer is not near the bile ducts. Usually it is preceded by three or four months of distress, indigestion, anorexia and loss of weight. Weir[39] states that over 90 per cent of jaundice cases can be diagnosed in a two-week period. It is inexcusable to allow jaundice to persist for a long period without a definite diagnosis. Unless there is unequivocal evidence of primary hepatocellular jaundice, we should explore surgically.

9. Diagnosis with the abdomen open: The surgeon is confronted with the serious responsibility of diagnosis. Kirtland[21] found seventy-seven cases in which an erroneous diagnosis of carcinoma had been made. Fortunately, in only nine of these was the patient subjected to the radical operation. In my series of nineteen cases the diagnosis seemed obvious. In every upper abdominal operation the pancreas is carefully inspected and palpated. One gets the "feel" of a normal gland or one with chronic pancreatitis. A localized firm mass can usually be palpated in cancer cases and the rest of the gland in contrast seems relatively normal. I recently had a case (Case x) in which gallstones were present in the gallbladder and a small stone was found in the ampulla. On palpating the pancreas we found a cancer in the head of the gland which was remote from the ampullar area. The rest of the gland was relatively normal in texture and we therefore performed a radical resection. We did not open the common duct because of the danger of spreading cancer cells.

Biopsies of the tumor should not be performed, as rarely can one get good sections for diagnosis. We believe that the danger of spreading cancer cells is so great that it outweighs any possible benefit. Cattell[9] suggests the use of needle biopsies but we believe they are useless and may spread cancer cells. The presence of firm lymph nodes is certainly suggestive. Removal of one for biopsy is less dangerous but still runs the hazard of cancer spread.

Cattell[9] lays great emphasis on dilatation of the common bile duct and the pancreatic duct. He states that the latter can usually be felt by palpation but suggests that aspiration of the duct could be done to determine if the pancreatic fluid is under tension. I prefer not to do this because of the danger of spreading cancer cells. Cattell urges that radical surgery not be performed unless dilated ducts can be demonstrated.

Mobilizing the duodenum allows better palpation and also is important in determing the operability.

CASE REPORTS

A critical survey will be made of our experience in our last ten cases.* Each of the following cases illustrates complications which we hope to avoid in the future.

Case 1. Hospital case No. 6521. F. McE., a seventy-one year old man, was admitted to the hospital on July 8, 1949, with a weight loss of 30 pounds, flatulent indigestion and burning sensation after food for six months. Jaundice appeared two weeks before surgery, was painless and insidious in onset. The liver was enlarged downward 2 fingerbreadths. The patient was explored on July 19th and carcinoma of the head of the pancreas was found. Total pancreatectomy including the omentum and spleen was performed. Cholecystojejunostomy was accomplished after pulling the jejunum up through the mesocolon (retrocolic). The patient reacted well to the operation and was ready to go home when acute upper abdominal distress developed to such an extent that exploration was necessary. At operation on August 15th we found that the anastomotic tube of jejunum was plastered down in the raw area from which the pancreas and duodenum had been removed and had become hopelessly obstructed. The cholecystojejunostomy had to be disconnected. The loop of jejunum was brought up anterior to the colon and the anastomoses re-established. The patient reacted poorly following surgery and died August 30th.

* All patients seen at the Queen of Angels Hospital, Los Angeles, Calif.

Comment. This case emphasizes my contention that no loop of small intestine should be brought up through the mesocolon into the raw, unperitonealized bed from which the duodenum and pancreas have been removed. It also demonstrates clearly how obstruction of the bowel may occur if this is done. We urge, therefore, that antecolic anastomosis should be performed in every case. We now cover the raw area by tacking the colon up high under the anastomotic loops. (Fig. 17.)

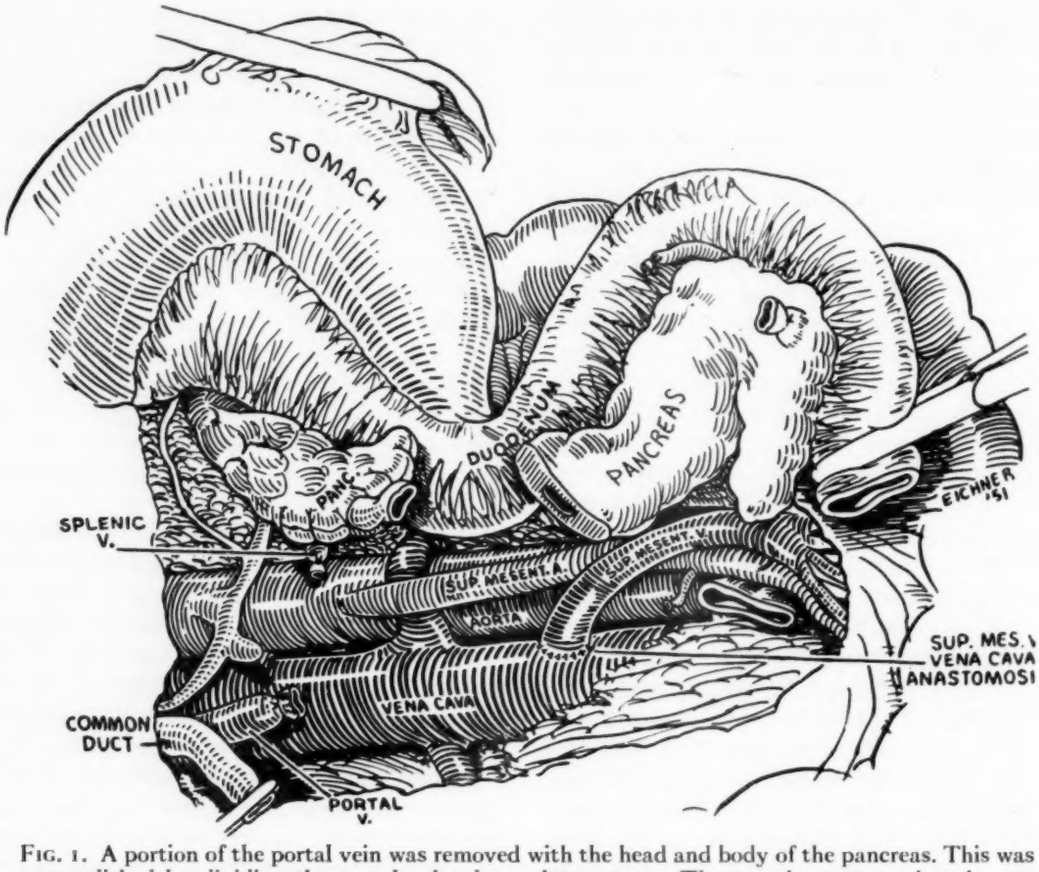


FIG. 1. A portion of the portal vein was removed with the head and body of the pancreas. This was accomplished by dividing the portal vein above the pancreas. The superior mesenteric vein was divided near the lower edge of the pancreas. The end was swung around and anastomosed to the inferior vena cava by a continuous suture of fine silk.

CASE 11. Hospital case No. 610. L. E., a sixty-eight year old woman, was admitted to the hospital on January 15, 1951, with the complaint of a 40 pound weight loss in three months. Two weeks prior to surgery, January 22nd, she had gradual onset of painless jaundice. At operation we found cancer situated in the uppermost part of the head of the pancreas. We performed a radical partial pancreaticoduodenectomy and found that the portal vein wall had become infiltrated by tumor posterior to the pancreatic neck. The common bile duct and the portal vein above the pancreas were divided; then the superior mesenteric vein was divided at a point just below the pancreas and turned down. The open end of the inferior vena cava was anastomosed about 1 inch below the renal veins. (Fig. 1.) During the procedure, which took about fifteen minutes, the patient had a severe drop in blood pressure. However, as soon as the inferior vena cava was released, the blood pressure rose again. Pancreaticoduodenectomy was then completed.

Comment. Postoperatively, the patient lived five days but suffered during this time from lower nephron nephrosis and evidence of cerebral anoxia. The patient never did react properly. At autopsy it was shown that all the anastomoses were intact and the anastomosis of the superior mesenteric vein and inferior vena cava was patent. Undoubtedly, question

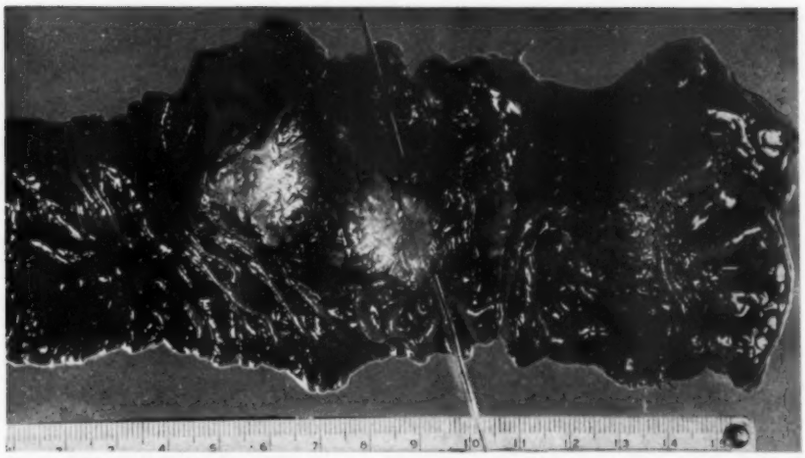


FIG. 2. Shows the duodenum opened. The tumor had bulged into the bowel but had not eroded the mucous membrane. The tumor is shown cut in two. It may be noted that the tumor is relatively small and well circumscribed. The probe is in the common bile duct which was occluded by external pressure of the tumor.

will be raised that this patient should have been regarded as inoperable and that the procedure outlined heretofore was not justified. It would seem, however, that if the aforementioned complications had not occurred this woman could have lived the same way that patients do after porta vena caval anastomosis for portal hypertension.

CASE III. Hospital case No. 216. G. P., a seventy year old woman, entered the hospital on January 6, 1951, with a loss of 70 pounds of weight in six months and with some pain in the upper abdomen and back. Jaundice was present for three weeks. A radical partial pancreaticoduodenectomy was performed on January 9th. We removed not only the head of the pancreas but also the body, leaving only the tail. In spite of this a small firm area was noted on the cut edge of the tail. Another slice of pancreas was removed. On histologic examination of this section (Figs. 2 and 3) cancer cells were seen in a lymph space, very remote from the tumor.

Comment. The patient died eight months later of metastasis. We are impressed by the spread of cancer into the ducts. Pancreatic juice contains free cancer cells which can implant anywhere in the gland. Anything less than total pancreatectomy seems futile.

CASE IV. Hospital case No. 10255. C. G., a fifty-eight year old woman, was admitted to the hospital on September 8, 1950. She had had a weight loss of 20 pounds in five months and diarrhea, anorexia and abdominal pain most intense in the upper abdomen three mree months; she had been jaundiced two weeks. She had carcinoma in the head of the pancreas and a radical partial pancreaticoduodenectomy was performed on September 20th. In this case the common bile duct was turned in, using two layers of sutures for the purpose. The fundus of the gallbladder was anastomosed to the end of the jejunum. Three days postoperatively the patient showed an increasing amount of jaundice, which became very intense. We took her to surgery on September 27th and opened the end of the common duct which had not healed solidly. Choledochojejunostomy was performed. It was evident that the turning-in process had apparently completely obstructed the cystic duct which had extended much lower than we thought. The patient made an uninterrupted recovery except for mild potassium deficiency and was sent home in good condition on October 15, 1950. When last seen one and a half years after surgery she was alive and well. She had gained 10 pounds in weight and had no complaints.

Comment. The lesson to be learned from this case is that the cystic duct sometimes runs down a long distance and may be obstructed if one turns in the end of the common bile duct. (Fig. 18.)

CASE V. Hospital case No. 775. E. C., a fifty-nine year old man, was admitted to the hospital on January 20, 1951, with a long history of duodenal ulcer and weight loss of 30 pounds. At surgery, January 24th, we found

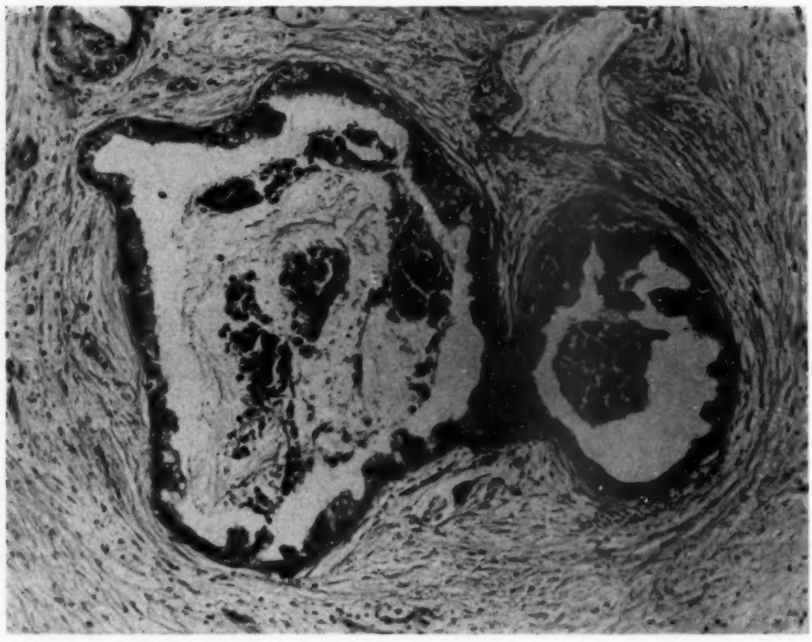


FIG. 3. A nodule was removed from the body of the pancreas at least 5 inches away from the tumor in the head of the pancreas. A section shows a background of rather dense fibrous connective tissue. In the central portion are several irregular groups of epithelial tumor cells which occur within glandular formations.

a prepyloric ulcer with partial obstruction. However, on exploration we found also a carcinoma of the second portion of the duodenum 1 inch below the ampulla. A radical pancreaticoduodenectomy was performed. The open end of the bile duct was found to consist of two tubes, i.e., the cystic duct and the common hepatic duct. I took a sharp-pointed scissors and inserted one blade into the cystic duct and the other blade into the common duct, and cut the partition between these two ducts into one. Formal anastomosis was then performed. In addition, we anastomosed the fundus of the gallbladder to the jejunum. In this instance the ducts of the pancreas were quite small, having suffered no obstruction. Anastomosis to the jejunum was made by opening the jejunum and inserting the end of the pancreas into the lumen of the duct and suturing the capsule of the pancreas to the serosa of the jejunum with two layers of interrupted fine silk. Postoperatively, there was no steatorrhea and it was believed that the pancreatic juice was getting into the jejunum in fairly normal amounts. One month after surgery the patient suffered a violent hemorrhage from the gastrointestinal tract. He vomited blood and had large tarry stools. The hemoglobin dropped to 46 per cent, red blood cells dropped to 2,500,000 and the blood pressure dropped to 80/50. The patient was reoperated upon March 3rd and a small bleeding gastrojejunal ulcer was found. The base of the ulcer was sutured with silk and a vagotomy was performed. The patient did well after the second operation and left the hospital March 28th. However, metastasis to the liver developed and he died on September 25, 1951.

Comment. Sufficient stomach should be removed to make gastrojejunal ulcer unlikely. Cattell[10] mentions finding one jejunal ulcer after the first stage. We believe that higher resections should be performed to remove more of the lymph drainage and protect against gastrojejunal ulceration. The stomach should always be last on the loop of jejunum so that bile will enter and further protect against ulceration. When operating upon the upper abdomen we routinely examine the pancreas and duodenum. Had we not done so in this case, the lesion in the duodenum would not have been found.

CASE VI. Hospital case No. 13311. R. R., a forty-eight year old man, was admitted to the hospital on December 8, 1950. Before this patient came under my care he had been oper-

ated upon twice, undergoing (1) cholecystojejunostomy and (2) gastroenterostomy. He gave a history of previous weight loss of 40 pounds and onset of jaundice with considerable abdominal distress. The stomach was not emptying and another operation was mandatory. On February 16, 1951, we performed a radical partial pancreatectomy. Following surgery the patient had severe anorexia and signs of liver damage. The albumin-globulin ratio became reversed, ascites developed and the patient gradually deteriorated and died April 24, 1951. Autopsy revealed early metastasis to the liver and retroperitoneal glands.

Comment. This case illustrates that the best time to perform radical surgery is at the first operation. Massive adhesions were present at the second and third operations. The tissues were edematous and were poor in quality. The liver was damaged by three operations instead of one.

CASE VII. Hospital case No. 3727. H. McG., a fifty-seven year old man, entered the hospital on April 4, 1951, with the history of having been operated upon by me for submaxillary tumor in Spetember, 1950. The diagnosis was malignant tumor, unclassified, metastatic to lymph node near the submaxillary gland. However, some of the histologic features suggested neural origin of the tumor. This was followed by block dissection of the neck. Careful study failed to reveal the origin of the metastasis. The patient felt well until one month prior to admission to the hospital. He had vague symptoms of indigestion and loss of 15 pounds of weight (5 pounds lost in the last month). Jaundice appeared ten days prior to surgery. A mass could be felt in the region of the pancreas, and the gallbladder was distended. At operation on April 6, 1951, we found a tumor which filled most of the head of the pancreas. Lymph nodes were adherent to the head and some of these seemed firm. Other nodes along the pancreas were soft. There were no metastases to the liver or other areas. A complete pancreatectomy was performed, including the omentum, spleen and two-thirds of the stomach. The pathologic diagnosis was malignant tumor suggesting neural origin of the tumor (neuroblastoma). The nodes adherent to the head of the pancreas showed metastatic carcinoma. Postoperatively the patient made an entirely uneventful recovery. He was well maintained on 30 units of insulin. He was also given choline, berocca, melactin and pancreatic granules. The patient was dismissed from the hospital on April 21, 1951.

Comment. The metastatic mass removed from the neck seven months before the pancreatectomy undoubtedly came from the pancreatic carcinoma. The patient has returned to work. He was feeling fine and had no apparent recurrence when seen one year later. The size of the pancreatic tumor with adherent metastatic lymph nodes might have marked this case as inoperable. However, his subsequent course has been so good that we may conclude the operation was worth while.

CASE VIII. Hospital case No. 6578. C. D., a thirty-five year old man, was admitted to the hospital on June 19, 1951. A total radical pancreaticoduodenectomy was performed on September 1st, including the gallbladder, spleen and high gastric resection. The pathologic diagnosis was obstructive adenocarcinoma at the ampulla of Vater, with extensive lymphatic permeation and regional lymph node metastasis. The patient made an uninterrupted recovery and left the hospital in excellent condition. Two weeks later he had a sudden massive hemorrhage into the abdominal cavity and died. At autopsy it was shown that the silk ligature on the gastroduodenal artery had cut through, causing severe hemorrhage.

Comment. The gastroduodenal artery presents a short thick vessel in its suprapancreatic portion. Ligation close to the hepatic artery is dangerous and yet we wish to keep as far away from the pancreas as possible. We suggest suturing the vessel in the future instead of employing ligation (Fig. 6.)

CASE IX. Hospital case No. 11851. B. B., a seventy-six year old woman, entered the hospital on November 10, 1951, with only a few weeks' history of general malaise. Stools were foul smelling and she had been jaundiced two weeks. At operation on November 13th we found a greatly enlarged liver with a comparatively small spleen. The bile ducts were only moderately enlarged, i.e., ½ inch in diameter. There was a firm area in the head of the pancreas which seemed to be behind and slightly to the left of the ampulla. A radical total pancreaticoduodenectomy was performed, including the gallbladder, common duct and spleen and a high gastric resection. The pathologic diagnosis was adenocarcinoma of the head of the pancreas of duct origin. A biopsy of the

liver was taken and reported as obstructive biliary cirrhosis. During convalescence the patient made a slow recovery of strength but left the hospital in good condition on December 22nd and has been well since.

Comment. The liver in most cases has suffered severe damage and this has to be taken into account in selecting the proper anesthetic agents. In this case the anastomosis to the hepatic duct was difficult. It is much easier to perform end-to-end anastomosis in most cases.

CASE X. Hospital case No. 1229. A. S., a sixty-nine year old woman, entered the hospital on January 19, 1952, with a three-month history of "heartburn," poor appetite and weight loss of 10 pounds. Ten days prior to admission jaundice was first noticed with itching of the skin. A total pancreaticoduodenectomy was performed on February 4th. This included the gallbladder, duodenum, spleen and two-thirds of the stomach. The pathologic diagnosis was adenocarcinoma of the head of the pancreas with constriction of the intrapancreatic portion of the common bile duct and metastatic carcinoma in a lymph node adjacent to the head of the pancreas. The patient made an uninterrupted recovery until the night of February 29th, when she suffered massive hemorrhage from the stomach and went into shock. The blood pressure came back to normal with blood transfusions but an hour later a second severe hemorrhage occurred and she promptly died. At autopsy a small erosion in the gastric mucosa was all that we could find to account for the hemorrhage.

Comment. In the ten cases reported herein we have had two cases of severe gastric hemorrhage. In neither of these cases was there an ulcer in the jejunum. We cannot blame it on the length of jejunum from the ligament of Treitz. In our next case we will make gastric acidity tests. Vagotomy has been suggested in these cases as an added safeguard against gastrojejunal ulceration.[23] In the postoperative care we have fed our patients choline and pancreatic granules. This patient complained of the latter burning and irritating the tongue and esophagus. We wonder if they were too harsh for the gastric mucosa. Certainly, we shall use something else in the future.

SPREAD OF CANCER

We owe a great deal of gratitude to the splendid work of Whipple,[40–43] Brunschwig,[5] Hunt,[20] Cattell[8,9] and others in making the progress shown to date. We do, however, believe that these operations fall very short of the necessary requisites. We must enlarge the scope of the surgery greatly and also change the fundamental principles. Before expressing our final opinion, let us first consider the spread of cancer in this area.

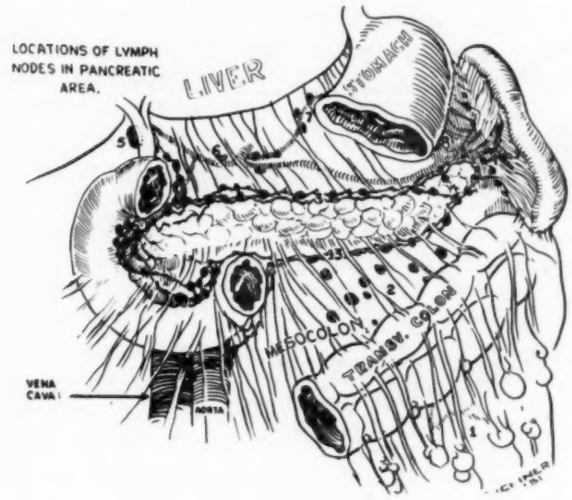
Direct extension occurs into the surrounding pancreas and into the bowel. Miller et al.[27] showed that in ten of thirteen cases of transduodenal resection of ampullar carcinoma there was cancer at the periphery of the resected area. We conclude that such local resections must be discontinued. Common bile duct extension occurs more frequently than has been thought. Miller states that examination of the transected common bile duct revealed that in four of twenty-nine cases cancer cells were present. Three showed perineural lymphatic invasion and the fourth showed malignant cells in a lymphatic sinus. This certainly suggests that the common duct should be divided at a higher level in all cases. We recommend that the gallbladder be stripped out of its bed from above downward and the common hepatic duct be divided above the entrance of the cystic duct. This allows the common duct and the gallbladder together with lymph nodes and periductal areolar tissues, including nerve fibers, to be removed *en masse*. These are left attached to the duodenum and pancreas in continuity.

The pancreas is permeated with ducts which contain cancer cells, and implantations occur throughout the gland. (Case III, Figs. 2 and 3.) In a similar manner, lymphatics and lymph spaces spread widely through the gland. It should be obvious that total pancreatectomy is necessary.

Lymphatic drainage from the pancreatic area is extensive. (Fig. 4.) I wish to draw particular attention to perineural spread along nerves coming down from the celiac plexus. This type of spread is very noticeable in this area. We know that lymph channels and chains of nodes accompany the blood vessels. When Figure 5 is studied, it must be obvious that if we are to encompass the maximum lymph drainage a high gastric resection is necessary. It is also necessary to remove the spleen. We consider the toilet of the posterior abdominal wall important. Areolar tissue with lymph nodes should be cleansed, particularly along the hepatic, celiac and left gastric arteries.

Venous spread is particularly apt to occur since the portal veins has many tributaries, some coming off directly from the pancreas. When the surface of the portal veins is invaded by cancer, the case has been considered inoperable. However, recently there have been suggestions that we might divide the portal vein above, the superior mesenteric below, and the splenic vein, and leave the intervening vein segment still attached to the pancreas in those cases in which the vein is infiltrated. I tried this on one occasion only. (Case 11, Fig. 1.)

The spread of cancer cells during surgery is a most important matter. Tumors should be handled with extreme gentleness. Squeezing or massage may force cancer cells out into venous or lymphatic channels. Cancer may be spread from any of the cut surfaces. Pancreatic ducts are often blocked early. The pancreatic juice accumulates in the ducts and is often under considerable pressure. This fluid often contains cancer cells. When the duct is severed, there is spillage of the contents into the general abdominal cavity. The same remarks hold true when the bile ducts are transected. There is evidence to show that the presence of pancreatic juice in the abdomen tends to favor the implantation of cancer cells.[43] Everything should be done to prevent the escape of these fluids into the general body cavity during operation. This in itself would seem reason enough for the performance of total pancreatectomy. Attempted biopsies in cancer cases only spread the cancer cells and do not yield sufficient information to warrant this risk. White[44] has recovered cancer cells from a scalpel used in a radical mastectomy. Surgeons should keep this in mind and change gloves and instruments more frequently. Every care, therefore, should be used to prevent the spread of cancer cells during surgery.



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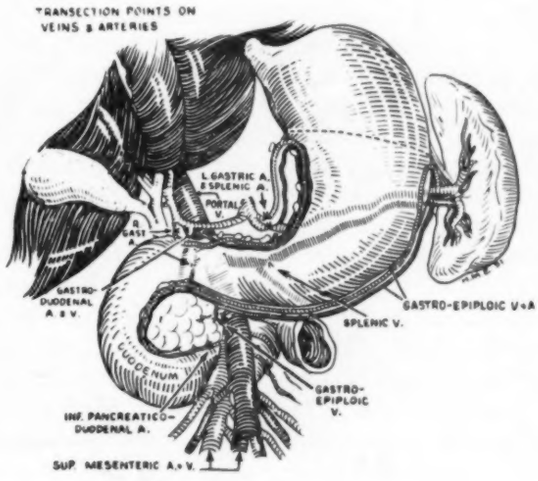

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FIG. 4. Lymphatic drainage is widespread to: (1) great omentum and gastrocolic omentum, (2) mesocolon, (3) along both sides of the pancreas out to the (4) hilus of the spleen, (5) lymph nodes along the common bile duct, (6) lymph nodes along the hepatic artery, the splenic artery and vein, (7) the left gastric artery, (8) the gastrosplenic omentum, (9) retroperitoneal lymph nodes, (10) along nerves (perineural lymphatics and lymph spaces), (11) along the greater and lesser curvatures of the stomach.

FIG. 5. The arteries of this area are shown as well as the veins: (1) celiac axis, (2) hepatic artery, (3) gastroduodenal, (4) right gastric, (5) pancreaticoduodenal superior, (6) pancreaticoduodenal inferior, (7) right gastroepiploic, (8) superior mesenteric, (9) duodenal, (10) left gastro-epiploic, (11) splenic, (12) left gastric, (13) portal vein, (14) splenic vein, (15) superior mesenteric vein, (16) gastro-epiploic vein. Lymphatics course along the vessels. To remove these adequately, the stomach should be resected at as high a level as indicated.

REQUISITES OF SURGERY

We may now conclude that we have been making many serious mistakes and that present day operations are woefully lacking. We believe that surgery of the future should have the following requisites: (1) Anything short of total pancreatectomy is useless. (2) Good anesthesia with the liberal use of blood is mandatory. (3) One-stage procedures. (4) Wide exposure is the best prophylactic against shock.

(5) *En bloc* operations starting at the periphery and working toward a given point and keeping all tissues in continuity. (6) Wide and extensive operation to include: cholecystectomy and resection of the common duct with its lymph nodes and areolar tissue and nerve fibers all in continuity; a high gastric resection to remove the maximum of lymph drainage and to guard against gastrojejunal ulcer (Cases v and x); the spleen; all the duodenum; and the areolar tissue and nodes along the hepatic, celiac and left gastric arteries. (7) The stomach should be the lowest of the anastomoses to guard against ascending infection and gastrojejunal ulcer. (8) The liberal use of vitamin K has materially controlled bleeding during and after surgery. We must warn against blunt dissection. The smaller tributaries of the larger veins should be divided and ligated; otherwise, large rents may be torn in the larger vessels. (9) The use of silk ligature is essential but we believe it is not safe merely to ligate a large artery as this may cut through and cause postoperative hemorrhage (Case VIII). We now believe that the vessel should be cut at an angle (to distribute intra-arterial pressure more widely) and should be sewn with an interlocking stitch. (Fig. 6.)

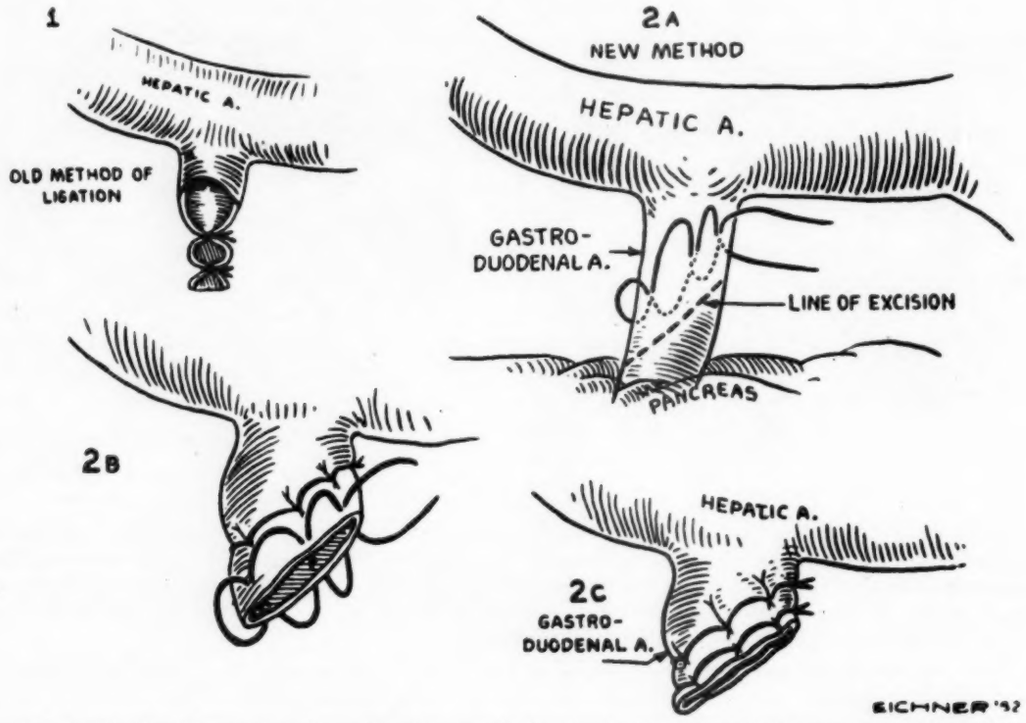


FIG. 6. The first illustration shows the older method whereby the short thick artery is ligated twice, using silk. It must be obvious that this silk ligature could cut through and allow a hemorrhage to occur. No. 2A demonstrates that the artery should be cut obliquely. This has a tendency to spread the intra-arterial dynamic force over a wider area. It may be noted that instead of ligating the artery it should be sutured as illustrated. No. 2B shows a second row of sutures in the artery. No. 2C shows that these two rows of sutures approximate a wide area of the arterial wall, giving the best possible chance for secure healing.

AUTHOR'S TECHNIC OF TOTAL PANCREATECTOMY

Figure 7. We use a wide transverse incision. A description of this was published in a previous paper.[34]

Figure 8. The rectus and oblique muscles are divided well above the rib cage and are then reflected downward. The transversalis and peritoneum are divided below the rib margin. The eighth and ninth nerves are preserved.

Figure 9. This illustration shows the excellent exposure obtained by such an incision. It is seldom necessary to use a retractor and we believe that this not only makes the surgery easier but also minimizes shock.

Figure 10. The duodenum is mobilized and the gastrohepatic omentum is opened, per-

mitting careful inspection and palpation of the pancreas. The omentum is separated from the transverse colon and is left attached to the stomach through the gastrocolic omentum.

Figure 11. The upper leaf of the mesocolon is stripped downward, exposing the superior mesenteric vein and its tributaries. The superior mesenteric vein is dissected from below upward. When the pancreas is reached, it is carefully elevated off the vein. Small venous tributaries are caught and tied. No blunt dissection is performed as such might tear a hole in the main vein. In this manner it may be definitely determined if the vein is invaded. If this were found, the operation could be discontinued as no important structures had been sacrificed to this point. During this dissection the gastroepiploic vein is ligated. The right gastric artery is now ligated and the gastrohepatic omentum is divided.

Figure 12. The gallbladder, cystic duct, the common duct, lymph nodes and areolar tissues are stripped down and left, in continuity, attached to the pancreas and duodenum. Before cutting across the bile duct it is doubly clamped and the lower end is ligated to avoid any spillage. Dennis and Varco[13] for some time have been removing the gallbladder and common duct and anastomosing to the hepatic duct.

Figure 13. Dissection along the upper border of the pancreas exposes the hepatic artery with the gastroduodenal artery (A). The gastroduodenal artery having been divided and ligated, the portal vein is seen (B). For details of ligation see Figure 6. The pancreas is lifted and the portal vein is dissected free from it. The splenic vein is now seen and is dissected for about one inch (C).

Figure 14. After ligating the inferior pancreaticoduodenal artery, we carefully divide and tie the duodenal branches of the superior mesenteric vessels. In this manner the terminal end of the duodenum is loosened. The proximal end of the jejunum is now pulled to the right, doubly clamped and divided. The uncinate process is then brought out from under the mesenteric vessels.

Figure 15. The duodenum and pancreas are now separated from the posterior structures and are turned over to the left. The splenic and left gastric arteries are doubly clamped and ligated near their origin. The splenic vein is also tied and divided.

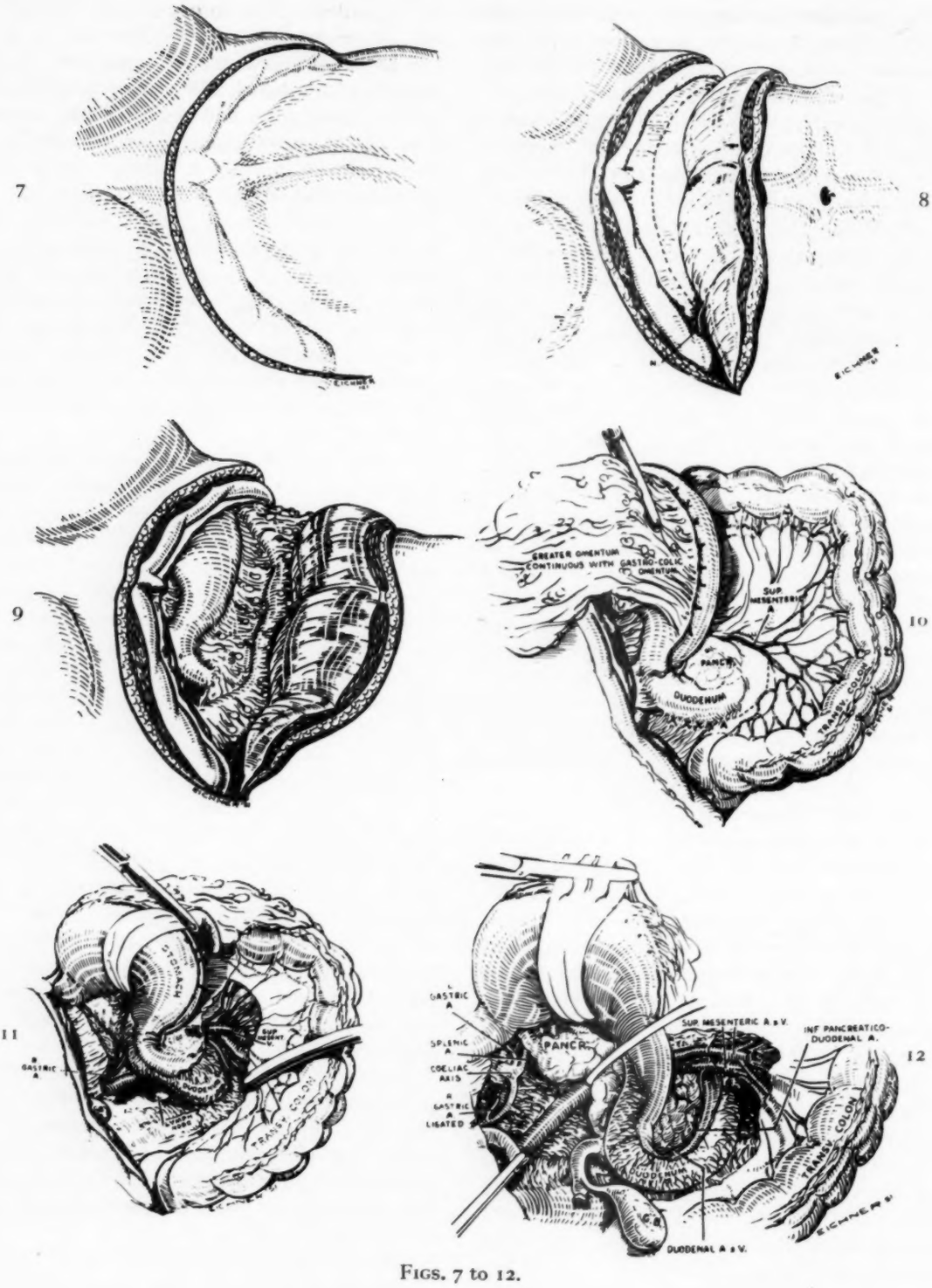
Figure 16. The spleen is now brought up, the lateral peritoneum divided and along with the tail of the pancreas is separated from the posterior structures. The spleen is left attached to the stomach by the gastrosplenic omentum. The above structures are now turned up over the chest *en masse*. A careful toilet of the posterior abdominal wall is now made. Any areolar tissue which might contain retroperitoneal lymph nodes is dissected away. Similar dissection is carried along the hepatic artery to the celiac plexus and up along the origin of the left gastric. When this latter artery is severed, the distal section, together with adjacent lymph nodes, is left attached to the portion of the stomach which is to be removed.

Figure 17. The clamped end of the jejunum is pulled down through the mesocolon and then up over the transverse colon. The end of the jejunum is closed. A choledochojejunostomy is performed end-to-side. End-to-end anastomosis may be used also. A liberal loop of the jejunum is now brought up over the colon and an anterior Polya-type partial gastrectomy is performed. The stomach is cut off above the left gastric artery and above where the gastroepiploic artery bends up from the splenic. (Fig. 5.) In this way the maximum lymph drainage is removed. A high gastric resection is also a safeguard against gastrojejunal ulcer. The transverse colon is brought up high under the anastomoses and sutured to the posterior peritoneum along the lower border of the liver. This effectually covers over the raw area from which the duodenum and pancreas have been removed and prevents postoperative obstruction. A Penrose drain is carried from this area out through the lateral end of the incision on both sides.

Figure 18. These drawings show the detail of formal choledochojejunostomy. Interrupted fine silk sutures are used throughout. The closed end of the jejunum is tacked up to the upper end of the hepatoduodenal ligament to prevent tension or pull on the anastomosis.

REMARKS

Operative mortality has been steadily reduced until now this is not a predominant factor. We have not found that total pancreatectomy by our method has added to the operative mortality. The last four patients underwent total pancreatectomy and all sur-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GREATER OMENTUM CONTINUOUS WITH GASTRO-COLIC OMENTUM
SUP MESENTERIC A
PANCR
DUODENUM
TRANSV COLON
11
STOMACH
GASTRIC A
DUODENUM
TRANSV COLON
12
GASTRIC A
SPLENIC A
COELIAC AXIS
GASTRIC A LIGATED
SUP MESENTERIC A & V.
PANCR
INF PANCREATICO-DUODENAL A.
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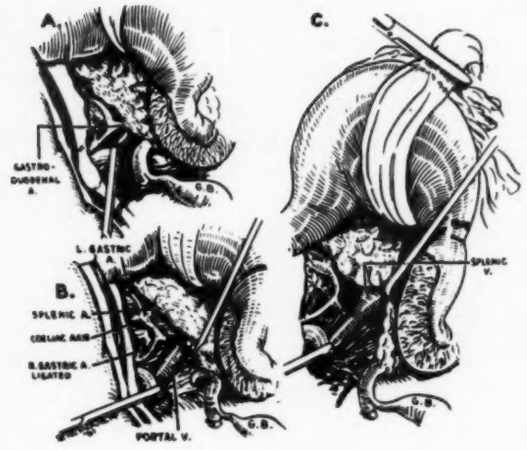
TRANSV COLON
DUODENAL A & V.

FIGS. 7 to 12.



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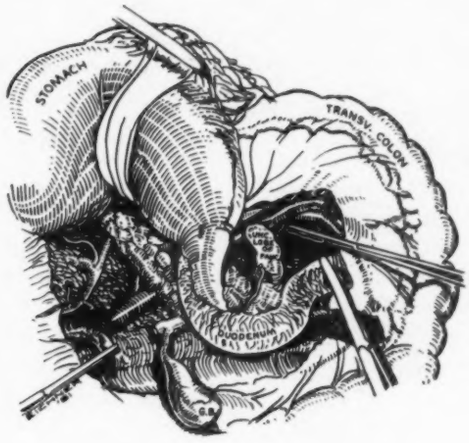

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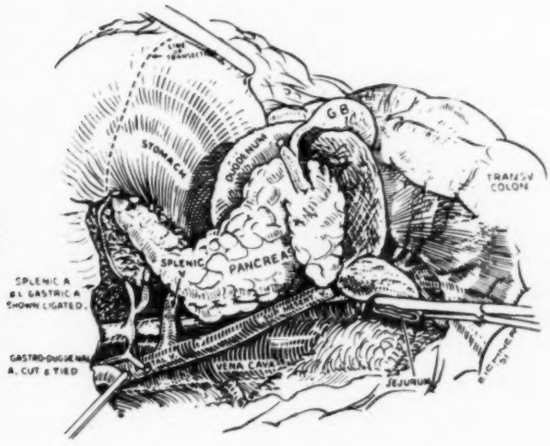

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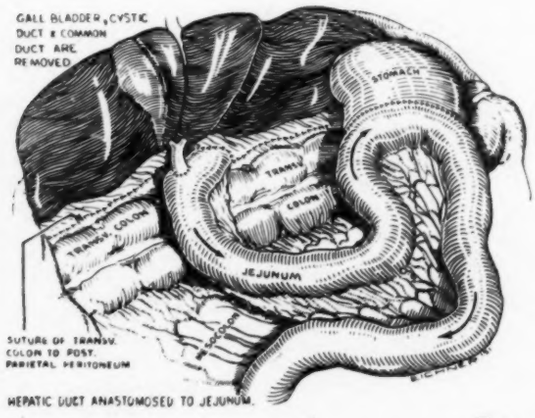
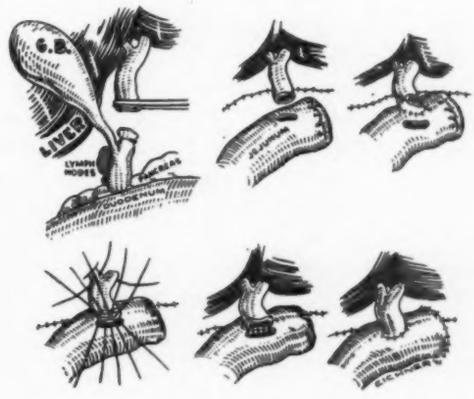

GALL BLADDER, CYSTIC DUCT & COMMON DUCT ARE REMOVED
STOMACH
TRANSV. COLON
JEJUNUM
SUTURE OF TRANSV. COLON TO POST. PARIETAL PERITONEUM
HEPATIC DUCT ANASTOMOSED TO JEJUNUM.

17



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FIGS. 13 to 18.

vived the operation. With better methods of diagnosis we hope to operate upon patients earlier. We believe that the more extensive operation will bring a higher number of permanent cures.

Undoubtedly, many will take issue with the idea of total pancreatectomy in all cases. Dragstedt,[14] working on dogs, showed that the body could do without the duodenum. Later he demonstrated that pancreatectomized dogs could live. However, fatty degeneration of the liver developed and they did not survive more than three years. Fisher[18] found that this liver degeneration could be prevented by feeding raw pancreas. Dragstedt[15,16] believes that the substance which could prevent this lipotropic action is an internal secretion possibly formed by the alpha cells. He called this substance "lipocaic." Best et al.[3,4] found that the liver could be protected by choline and lecithin.

Brunschwig,[5] working with monkeys, found that their livers did not undergo fatty degeneration to the same degree as that of dogs. It is believed that human beings have still more resistance. There may therefore be a racial protection. If, then, we give choline and pancreatic extract following pancreatectomies, there is reason to believe that the human being can live indefinitely. Gaston[19] has reviewed the postoperative care and progress of seventeen patients who had had pancreatectomies. He emphasizes that at first there is a sensitivity to insulin so that these cases must be handled with extreme care. There is not sufficient evidence to substantiate the thought that this sensitivity increases with the lapse of time. It can be reasonably assumed that after they become stabilized their care becomes less difficult. Whipple[42] states that these people will suffer some lack of digestion and absorption of food. He suggests that this is a relatively minor consequence and does not preclude operation.

We do agree that only after following a larger number of total pancreatectomies for a longer period of time may the problem be satisfactorily evaluated. The distressing results obtained so far in the lesser operation may give us courage to try a series of total pancreatectomies.

CONCLUSIONS

In this article we report our ten most recent cases. We are not proud of the results but believe it would be advantageous for all to learn of our difficulties and complications. A review of the pathology is made, particularly with reference to the spread of cancer in this area. We conclude that anything less than total pancreatectomy is useless. We have also suggested rules for surgery and finally have described the operation which we are now performing. No operation can be perfect but we believe that this may give us much better results in the future than are being obtained by the lesser operation.

SUMMARY

A brief history, the author's statistics and diagnosis are given. A series of ten cases is presented, with a discussion of the complications and the lessons that may be learned. The spread of cancer in the pancreatic area has been discussed and the requisites of pancreatic surgery outlined. The surgical technic of total pancreatectomy as performed by the author is described and is illustrated in detail. Postoperative physiology has been discussed and conclusions drawn from this critical survey.

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Complete Urinary Retention in the Female

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COMPLETE retention of urine has been so commonly associated with the male that its occurrence and significance in the female have not been fully realized. Although in common practice its incidence is admittedly infrequent, an analysis of the literature and our own recent experience reveal that it is not a rare and unusual finding. It is the purpose of this paper to review the subject of complete urinary retention in females and to present cases illustrative of a wide variety of etiologic factors.

A classification based on etiology seems most valuable in determining potential types of retention in women, and we have modified a table presented by Everett.[1] Following each of the major headings are examples, some quite common but others only rarely observed.

CLASSIFICATION

(1) *Intrinsic Obstructive Factor:*
Contractures of the vesical neck, muscular and glandular hyperplasia of the vesical neck, inflammatory processes at the bladder neck, the female prostate in masculinizing tumors, urethral stenosis and stricture, periurethral abscess, vesical calculus, tumors of the bladder and urethra, blood clots occluding the vesical neck, congenital valves, prolapsed mucosa of trigone, large urethral diverticula.

(2) *Extrinsic Obstructive Factor:*
(All of these produce pressure and angulation of the urethra and bladder neck from without.) Incarcerated uterus in pregnancy, pelvic abscess, myomas (particularly the submucous variety protruding into the vagina), hematocolpos due to imperforate hymen, hydrometrocolpos, endometriosis, appendiceal abscess, adnexal tumors, massive fecal impaction.

(3) *Psychogenic and Neurogenic Factor:*
Tabes dorsalis, paraplegia, myelodysplasia, multiple sclerosis, cord tumor, diabetes, hysteria, banthine and other related drugs, postoperative abdominoperineal resection.

(4) *Perineal Relaxing Factor:*
(These act by producing marked angulation and distortion of the urethra.) Large cystocele, procidentia, postoperative abdominoperineal resection.

The foregoing tabulation permits one to understand more easily the pathogenesis of female retention of urine. It would be unusual in either hospital or private practice to observe all or even many of these varieties. We have, however, studied this subject because within the past three years seventeen examples of this entity, caused by a representative group of lesions, have been observed by us.

CASE REPORTS

The Intrinsic Obstructive Factor

CASE I. M. G., age eighty-six, was admitted with severe suprapubic pain and complete inability to void for twenty-four hours. A similar episode had occurred five years previously and had responded well to a single catheterization. The bladder was palpable above the umbilicus and contained 1,800 cc. of urine. Except for the picture of an aged and distressed female, other physical findings were within normal limits. Cystoscopy revealed a typically fibrotic obstructive lesion of the bladder neck. Blood urea nitrogen and intravenous urograms were normal. A transurethral bladder neck resection was performed and an immediate excellent result was obtained. Histologic section showed fibrosis with chronic inflammatory change.

CASE II. M. M., age fifty, was admitted six weeks following a suprapubic vesicolithotomy and left nephrolithotomy. Complaint was inability to void and sudden recurrence of a suprapubic urinary fistula. She was otherwise well with normal blood chemistry and blood count. Endoscopy revealed a slightly trabecu-

lated bladder and a normal bladder neck. Waterway was excellent. After prolonged urethral catheter drainage the fistula closed but upon catheter removal residual urines averaged 500 cc. After several days acute retention recurred and the suprapubic tract reopened. Cystometry revealed an atonic bladder and a trial on furmethide® was ineffectual. Finally, in spite of a normal-appearing bladder neck, resection was performed transurethrally, removing a very small amount of tissue. Following this procedure the fistula closed, the patient voided well and residual urine determinations were normal.

Case III. M. B., age sixty, came to the hospital with a history of severe dysuria. On admission she could void only a few drops with great difficulty. Catheterization revealed a retention of over 1,000 cc. of turbid urine. Endoscopic study showed very severe cystitis with multiple minute vesical calculi which could be washed out. The bladder neck was essentially normal. Retrograde pyelograms demonstrated advanced bilateral hydronephrosis with hydroureter and a cystogram revealed bilateral ureteral reflux. The urea nitrogen was 50 mg. per cent. Neurologic examination was negative. Because of the patient's extremely poor general condition cystostomy was delayed and she was maintained on catheter drainage, intravenous fluids and antibiotic therapy. In spite of this regimen she finally became azotemic and comatose. Cystostomy was no longer feasible. Coma deepened and the patient died.

In retrospect, it is believed that immediate cystostomy prior to investigation and in spite of her poor general condition might well have provided better drainage and a more advantageous eventual result. Permission for autopsy was not obtained.

Case IV. D. C., age fifty, was admitted with complete inability to void. She had noted urgency for several years and grossly bloody urine for one week. The bladder was palpable at the umbilicus. Initial attempts at catheterization were unsuccessful. A granular polypoid meatal lesion was encountered which narrowed the external meatus to pinpoint size. Finally, using a filiform whip and follower, the bladder was emptied of 1,000 cc. of turbid urine. The urethra was gradually dilated and within a week the patient tolerated continuous Foley catheter drainage without difficulty. Cystoscopy revealed a granular, reddened, redundant lesion involving the entire urethra but most marked at the external meatus. Histologic sections taken by biopsy on several occasions showed an inflammatory reaction. The bladder, upper tracts and blood chemistry were normal. Eventually the patient could be dilated with ease using an F. 26 metal sound. She was discharged well.

Comments. Case I represents a typical contracture of the bladder neck as is so often described in the literature. Simple resection provided a cure. In case II cystoscopic findings did not suggest an obstructive lesion but empiric resection achieved a good result. Although etiology is uncertain, we believe Case III represents an intrinsic bladder neck obstructive factor and that resection, if performed early in the course of the disease, might have altered the course of events. The fourth case represents a less frequently observed lesion causing acute retention. The exact pathogenesis is uncertain, but we are at least dealing with an inflammatory intraurethral lesion with resulting secondary stenosis and stricture.

The etiologies of partial and complete retention of urine in women are similar. There is little doubt, however, that the most frequent cause of both types is an intrinsic obstructing lesion of the vesical neck. For many years this was considered to be primarily a male disease and it was not until 1921 that Caulk[2] reported on the significance of bladder neck obstruction in females. Since then numerous reports have concerned themselves with this problem and there is still considerable uncertainty as to the exact pathologic disease. The female urethra has been carefully studied for evidence of glandular tissue resembling the male prostate. Johnson[3] obtained data tending to prove that the entire homologue of the prostate was evident in the female urethra. Later Folsom[4,5] and Young[6] stressed the occurrence of prostatic type tissues in the female. Deter et al.[7] found periurethral glands in 92 per cent of 100 female urethras which they studied and concluded that these were homologues of the male prostate.

Contrary to these opinions, we note that Foley[8] favored an inflammatory process not related to a glandular type of tissue. Nesbit,[9] Winsbury-White[10] and Thompson[11] also have reviewed the subject and stress the presence of inflammatory change with fibrosis. They do

not confirm the presence of glandular elements. Cabot and Shoemaker[12] in fifty-nine postmortem studies found no glandular structures. Baurys[13] remarked that the etiology was obscure but that it is a fibrotic lesion probably related to an inflammatory process. Ritter and Shifrin[14] confirm this with their report. A very careful study in the newborn female was completed by Beneventi,[15] and he decided that in less than 10 per cent there is a rudimentary female prostatic structure which might, at a later date, hypertrophy and cause obstructive symptoms. Engels[16] believed that several small glands, similar to the glands of Albarran, could harbor infection and undergo hypertrophy. Emmett et al.[17] in 1950 emphasized that these bladder neck lesions are more common than supposed, that glandular hyperplasia does not seem to be an important factor and that when glands are observed they are in reality the subtrigonal glands of Albarran.

In evaluating these data one finds, therefore, many theories as to etiology, with conflicting statements as to pathologic findings but a uniform opinion as to therapy. Electroresection of the bladder neck is effectual. In all cases symptoms are similar to those seen in the male. Endoscopically there is usually some evidence of thickening and elevation of the floor of the bladder neck. At times there will be retention where endoscopy shows no abnormality and yet where resection affords relief of symptoms. In the great majority secondary muscular hypertrophy of the bladder will be found, with trabeculations and cellules. Histologic section obtained from the resected bladder necks usually show fibrosis with inflammatory change rather than glandular hyperplasia, although the latter has been championed by some authors.

Among the other intrinsic lesions is the rare finding of a redundant flap of tissue originating at the distal trigone and blocking the vesical neck in ball-valve fashion. Chute[18] presented such a case with cure by excision of the redundant mucosa. Several years later Neff[19] reported two additional examples, treated similarly, with excellent results.

The Extrinsic Obstructive Factor

Case v. W. G., age sixty-five, was admitted with a complete inability to void and severe pain suprapubically. The bladder could be palpated at the umbilicus. Catheterization relieved the distress but was accomplished with difficulty due to a very tight urethral lumen. Except for the finding of a very large solid fecal impaction, all other findings were negative. The impaction was manually removed and the patient then voided with ease and emptied her bladder normally. Endoscopic study and excretory urography were negative. Neurologic examination was normal. She was discharged free of urinary complaints.

Case vi. M. S., age seventy, was admitted with a complete inability to void. She had been catheterized at home one day prior to admission for the same complaint. The bladder contained 700 cc. of urine. Vaginal examination revealed a large impacted pelvic mass the size of a ten-week gestation. The mass was fixed, firm and could not be disengaged from the pelvis. Cystoscopy revealed a marked extrinsic pressure defect of the entire urethra and bladder floor. Renal function was good. The patient was referred to the Gynecological Service where exploratory laparotomy revealed a large impacted fibromyoma. Hysterectomy was performed and recovery was uneventful. Follow-up examination revealed complete elimination of urinary complaints.

Case vii. M. O., age forty-three, was admitted with a history of complete retention of urine of forty-eight hours' duration. The uterus was enlarged and fixed within the cul-de-sac. A cystourethrogram revealed marked pressure and angulation along the floor of the bladder and particularly at the vesicourethral junction. At cystoscopy the bladder showed evidence of marked posterior and inferior extrinsic pressure. Upper tracts were normal, as were the blood studies. An exploratory laparotomy performed on the Gynecological Service revealed a large intramural fibroid occupying the entire corpora of the uterus. Hysterectomy relieved her urinary symptoms.

Case viii. L. B., age fifty-four, had a six-hour history of inability to void. Urinary difficulties had increased over a two-week period. The bladder was above the umbilicus. Vaginal examination revealed a uterus the size of a six-month gestation causing marked vaginal wall compression. Intrinsically, the bladder and bladder neck were normal. Hysterectomy revealed an enormous submucous fibroid. The patient has been free of urinary complaints since surgery.

Case ix. E. C., age thirty, was seen in the emergency room in severe distress and completely unable to urinate for twelve hours.

She was in the latter part of the third month of her fourth pregnancy. In previous pregnancies there were no noted urinary difficulties. The bladder contained 1,200 cc. of clear urine. Pelvic examination revealed a gravid uterus, retroverted and lying firmly in the true pelvis. On manipulation it proved to be incarcerated. She was referred to the Prenatal Clinic for further study.

Comments. In all of these cases some extrinsic lesion, by producing sufficient pressure and angulation of the urethra or bladder, particularly at the bladder neck, creates obstruction to the waterway. We have not encountered in the literature an example of complete retention of urine secondary to fecal impaction as noted in Case v. In the aged with urinary complaints one should think of the possibility of pressure by such a fecal impaction.

Cases vi, vii and viii all demonstrate complete retention due to fibromyomas large enough and firm enough to create extensive urethral compression or distortion. Procar and Baques[20] have reported acute retention due to a twisted myomatous uterus. The submucous type of fibroid, particularly when it protrudes into the vagina, is most prone to cause urethral obstruction.

Case ix coincides with many presented in the literature. Urinary difficulty as a result of the pregnant uterus is a much less rare cause than previously supposed. The uterus is always retroverted and retroflexed and becomes lodged within the true pelvis. The late first trimester is the most frequent time for such development. Smellie[21] and Crabtree[22] have both demonstrated the pathogenesis of this syndrome. Burdon et al.,[23] Seidner et al.[24] and Spring and Hymes[25] have added examples of this complication. The effects of pregnancy on the bladder itself long remained neglected, yet the bladder does undergo changes somewhat similar to those seen in the ureters. Langworthy and Brack[26] demonstrated that progesterone caused an increase in vesical capacity and loss of vesical tone in the rabbit. In the human, Muellner[27] proved the occurrence of increased vesical capacity in the latter part of the first trimester. In the main, however, it is the mechanical pressure of the cervix of the retroverted incarcerated pregnant uterus which interrupts urinary flow. Once wedged between the pubis and sacrum, the growing and expanding uterus causes a constantly increasing degree of extrinsic pressure until complete obstruction intervenes. The treatment is simple and consists of vesical decompression followed by manual replacement of the uterus.

Among the rare but reported causes of acute retention in females on the basis of extrinsic pressure are hematocolpos and hydrometrocolpos. Snodgrass[28] and Lazarus[29] reported on cases of hematocolpometra. In all three patients there was an imperforate hymen. With the onset of menstruation hematocolpos develops and as a late result the cervix dilates and the uterus fills with blood resulting in a hematocolpometra. The rectal examination is classical and reveals a large, doughy, fluctuating mass in the vagina and cul-de-sac. Urethral occlusion results from direct pressure and also from urethral angulation because of forward pressure of the uterus on the posterior wall of the bladder. Treatment involves excision of the hymen. Lide and Coker[30] have reported on congenital hydrometrocolpos which occurs usually in infancy or in early childhood. Two factors are responsible, namely, a congenital obstruction in the lower vagina and hypersecretion above the point of obstruction. The enormous cystic dilatation of the vagina and uterus can be relieved by incision of the imperforate vaginal septum. Both of these factors are rare but should be considered when retention occurs in the female infant or adolescent. We have had no personal experience with the problem.

The Neurogenic and Psychogenic Factor

Case x. E. S., age twenty-eight, was first seen with a history of low back pain of one week's duration. Four months previously she had fallen and since then had noted difficulty in voiding. Frequency and dysuria were present. A complete workup including neurologic study was negative. Residual urines averaged 750 cc. On furmethide therapy the patient responded well but after four months she experienced repeated episodes of acute retention of urine. Cystometric study showed an atonic bladder. After six months of study and numerous therapeutic trials she was referred to a psychiatrist. Following psychotherapy symptoms began to subside and residual urines gradually decreased. Final impression was one of recurring and, at times, complete retention on a hysterical basis.

Case xi. C. F., age forty-eight, was admitted to the General Surgical Service with severe abdominal pain. History revealed that

she had been vomiting and that neither stool nor flatus had been passed for twenty-four hours. There was a large, firm, tender midline mass. The abdomen was rigid and tender in all quadrants. Temperature was 102°F. The original impression was that of an acute condition of the abdomen. This mass, however, was a bladder containing 1,800 cc. of clear urine. Once emptied, all complaints disappeared and on catheter drainage the patient recovered rapidly. She was then transferred to the Urologic Service. Cystoscopy revealed a trabeculated bladder. Urea nitrogen was 11 mg. per cent. Upper tracts were normal. A neurologic examination revealed evidence of posterior column and lateral tract disease, and a diagnosis of posterior lateral sclerosis was made. Pernicious anemia studies were negative. Cystometry showed a hypertonic bladder. She improved greatly on syntropan,® with a reduction of residual urine volume to 50 cc. She was discharged with urologic symptoms markedly improved.

Case XII. I. W., age forty-two, had complete colon resection including the rectum for multiple polyposis with carcinomatous degeneration. Following surgery she was completely unable to void. After several days of catheter drainage she was given a trial without a catheter and again acute retention of urine developed. Prostigmin was of no help. She was maintained for several weeks on intermittent catheterization. Eight weeks following surgery she was admitted for further study. The upper tracts were normal. Cystometric readings showed an autonomous hypertonic bladder with a 350 cc. capacity. Cystogram showed trabeculations with no funneling and no reflux. Endoscopy showed a small capacity, trabeculated bladder. The internal sphincter appeared thickened and spastic. A moderate bas-fond was noted. Syntropan and ephedrine helped the patient to void but residual urines remained above 400 cc. Two transurethral resections were performed one week apart and she then voided normally with a residual of 20 cc.

Case XIII. S. M., age forty-five, was admitted with left lower quadrant pain and inability to void. The bladder was palpable at the umbilicus. Blood and urine studies disclosed severe diabetes with acetonuria. Neurologic examination showed a positive Romberg with absent patellar and Achilles tendon reflexes. Position sense was disturbed in both lower extremities. Neurologic impression was posterior column disease. There was no pernicious anemia. Intravenous urography demonstrated no defects but concentration was poor. Cystourethrogram showed an early funnel urethra. Cystometry indicated a hypertonic autonomous bladder. The final impression was diabetic neuropathy with bladder involvement.

Case XIV. R. E., age fifty-six, was admitted one month after a second cerebrovascular accident. The first episode had occurred four years previously. Urinary difficulties had been severe for one month and a catheter was in place upon admission. The catheter was removed and the patient was unable to void. Repeated trials without a catheter found her in recurrent complete retention on each occasion. Cystometric reading was reported as a hypotonic bladder. After three days of furmethide therapy the catheter was again removed and she voided well. Residual urines gradually diminished to normal. Furmethide therapy was discontinued after several weeks.

Case XV. V. A., age thirty-five, had a history of numerous and diffuse complaints involving many systems. No organic basis for these had been noted. Upon admission she complained of abdominal pain, pain in the neck and vomiting. While in the hospital acute urinary retention suddenly developed. Neurologic examination was negative. Urologic study was normal except for the finding of a hypotonic bladder. A psychiatrist considered this to be a case of hysteria. She remained in retention until furmethide therapy was instituted. She then improved and was finally discharged voiding nearly normally.

Case XVI. C. S., age forty-two, had a long history of duodenal ulcer. She was seen at home with sudden complete urinary retention which occurred one day following the onset of banthine® therapy. The bladder contained 1,400 cc. of clear urine. The drug was eliminated and she became free of urinary complaints. A urologic study was normal. Several weeks later a second trial of banthine in smaller doses again produced retention of urine.

Comments. This group of psychogenic and neurogenic disorders as causes of complete retention of urine is a large one and not fully understood. It is beyond the scope of this paper to attempt to analyze thoroughly all the factors involved. There is little doubt that multiple minor urinary complaints are often observed on a functional basis. Rarely, complete retention as noted in two of our cases can and does

occur in true hysterias. In these patients the bladder is most frequently described as atonic and a parasympathomimetic drug may be of value. The response to psychotherapy is often impressive.

According to Straub et al.[31] alteration in bladder function may occur and may be the only symptomatic evidence of an emotional disturbance. During the last war acute urinary retention was seen at times in soldiers subjected to the stress of combat. These patients when studied often improved completely following pentothal® narcosis. By studying twenty-six patients they determined that there was a very definite correlation between urinary dysfunction and the emotional status. They believe finally that such psychosomatic phenomena must be considered as a potential cause of bladder disturbance in the absence of positive organic findings.

In many of the neurogenic lesions the bladder is also hypotonic or atonic, although in Cases XI and XIII a hypertonic bladder was noted. This has not been an unusual finding in our experience.

CASE XVI demonstrating retention following banthine therapy presents a problem now fairly well known to both the internist and the urologist. The drug exerts a depressant effect on the detrusor muscle by blocking parasympathetic action. Recently there have been reports on its effects on the bladder by Lapides and Dodson,[32] and Keizur and Hodges.[33] In sufficiently large doses complete urinary retention may easily result.

Case XII brings up a topic about which much has been written and about which there is still considerable disparity of opinion. Abnormalities of urinary function are a fairly common sequela of operations for removal of cancer of the lower bowel. Reports on the frequency of this complication vary anywhere from 10 to 100 per cent. The cause of urinary retention following abdominoperineal resection is not clear. Campbell and Gislason[34] have reviewed this subject thoroughly. McCrae[35] has postulated that such retention is of neurogenic origin resulting from trauma to the pelvic plexus. He believed that there is a surgical parasympathetic denervation resulting in loss of detrusor action. However, Coller and Eastman[36] and Marshall[37] have concluded that there was no evidence of loss of neural function after a study of such a group of patients. It is the belief of Emmett,[38] Marshall[37] and Ewert[39] that the most important factor in these cases is the loss of perineal support. However, cystourethrography and cystoscopy fail to show typical similar findings in all instances and in addition some do and others do not respond well to endoscopic resection. In view of these discrepancies, Campbell and Gislason[34] have been impressed by the presence of bladder fixation and they have mentioned traumatic pericystitis as the cause of the inability of the detrusor to function. Treatment is variable and consists of catheterization, tidal drainage, transurethral resection and vesical suspension.

The Perineal Relaxing Factor

CASE XVII. R. S., age sixty-five, was admitted with a complaint of long-standing urinary difficulty. Upon examination she could not void more than a few drops of urine, and 600 cc. of urine were obtained on catheterization. Urea nitrogen and urography were normal. Vaginal examination revealed a large, third degree cystocele. Cystoscopy disclosed a trabeculated bladder with a large bas-fond. Following the introduction of a supporting pessary the patient improved greatly.

Comments. This case is an example of a perineal relaxing lesion (large cystocele) which is caused by sharp angulation of the bladder neck resulting in complete obstruction. If one agrees with the Emmett and Marshall theory concerning the etiology of retention following abdominoperineal resection, that group should be included here. Hutchins[40] has discussed the importance of the relationship of the pelvic floor to the base of the bladder. He believes that it is a change in the urethrovesical angle which contributes to urinary difficulty in these postoperative states and in females with large cystoceles.

CONCLUSIONS

It is obvious that retention of urine in females, particularly the partial variety but also the complete, is not a singular finding. It is our impression that routine catheterization of the female, if instituted as a standard procedure in genitourinary investigations, would disclose an even greater number of such instances. Our cases have demonstrated a wide variety of etiologic agents such as contractures of the bladder neck, urethral inflammatory lesion with stenosis, fibromyomas, pregnancy, fecal impaction, hysteria, cerebrovascular accicent, diabetic neuropathy, posterior lateral

sclerosis, banthīne, cystocele and postoperative abdominoperineal resection. Important issues concerning some of these have been discussed. Of particular interest is the fact that all of these seventeen women were at least at one time in complete urinary retention.

SUMMARY

Seventeen cases of complete urinary retention in the female, demonstrating various etiologic factors, have been documented. A classification based on etiology has been formulated. Important features of the various types of cases have been discussed.

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Lower Nephron Nephrosis (Ischemuric Nephrosis)

WITH SPECIAL REFERENCE TO HEMORRHAGIC DIATHESIS FOLLOWING INCOMPATIBLE BLOOD TRANSFUSION REACTION

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LOWER nephron nephrosis (ischemuric nephrosis is probably a better name) occurs most commonly in military personnel as a complication of (1) shock or (2) a blood transfusion reaction. The majority of such patients are young and a have a long life expectancy if the present illness is not fatal. If properly treated most patients will recover.

CASE REPORTS

CASE I. A twenty-four year old soldier had a transplantation of the insertion of the subscapularis muscle for recurrent dislocation of his shoulder on August 8, 1952. During the operation he was inadvertently given 1,000 cc. of type A blood, the patient being type O. This was due to mismatching. No clinical reaction occurred, as the patient was under anesthesia. However, the first urine specimen was filled with hemoglobin, the blood serum was colored with free hemoglobin and it was evident that a hemolytic reaction had occurred. Urinary output, fluid intake and serum potassium are shown in Figure 1. During the phase of diuresis the non-protein nitrogen continued to climb even though the urinary output had increased tremendously. However, the blood potassium which had been accumulating dropped precipitously shortly after diuresis had started. A hemorrhagic tendency manifested itself by ecchymosis about the wound and bleeding from the nose and rectum. Blood studies revealed a prolonged prothrombin time. Fibrinolysin studies were not done. By the fifteenth day recovery was well underway. The wound healed well and the patient has obtained a good result from his muscle transplant.

CASE II. A thirty-one year old white woman was admitted to this hospital on July 3, 1950, with right flank pain, weakness, chills and fever. She had already undergone an appendectomy and right oophorectomy at another hospital for right flank pain, without benefit. She was anemic and required several transfusions to bring her blood to normal level. Studies showed severe nephroptosis with kinking of the ureter on the right. Pus was obtained from the right kidney. A right nephropexy was performed on July 14, 1950. During the operation the patient inadvertently received 500 cc. of type A blood, the patient being type O. This was due to mislabeling. No clinical reaction was noted because the patient was under anesthesia. However, the first postoperative urine specimen was full of hemoglobin and the blood serum was also markedly colored with free hemoglobin. A hemorrhagic tendency developed which was manifested by bleeding from the nose, mouth and rectum. Blood studies revealed a prolonged prothrombin time. Fibrinolysin studies were not done. Oliguria varying from 10 to 60 cc. of urine a day persisted for eight days. Fluids given consisted mainly of 10 and 15 per cent glucose to permit intake of as many calories as possible. Recovery was nearly complete by the sixteenth day. The patient recovered completely and has been symptom-free since. Complete kidney work-up one year later revealed normal kidney function and intravenous pyelogram.

CASE III. A twenty-one year old soldier sustained a severe compound comminuted fracture of the left femur and acetabulum in Korea

on April 3, 1952. The wound produced severe shock. Infection and osteomyelitis developed. After one of eleven transfusions a pyrogenic and hemolytic transfusion reaction occurred. This was complicated by severe bleeding from the wound and oliguria with a urine volume of

the wound. The wound bled relentlessly in spite of the use of thrombin, pressure dressing, fibrin and other measures, and the patient was in shock for several hours. Fibrinogen was not available at the time. He received 8,000 cc. of bank blood and 3,000 cc. of fresh blood in

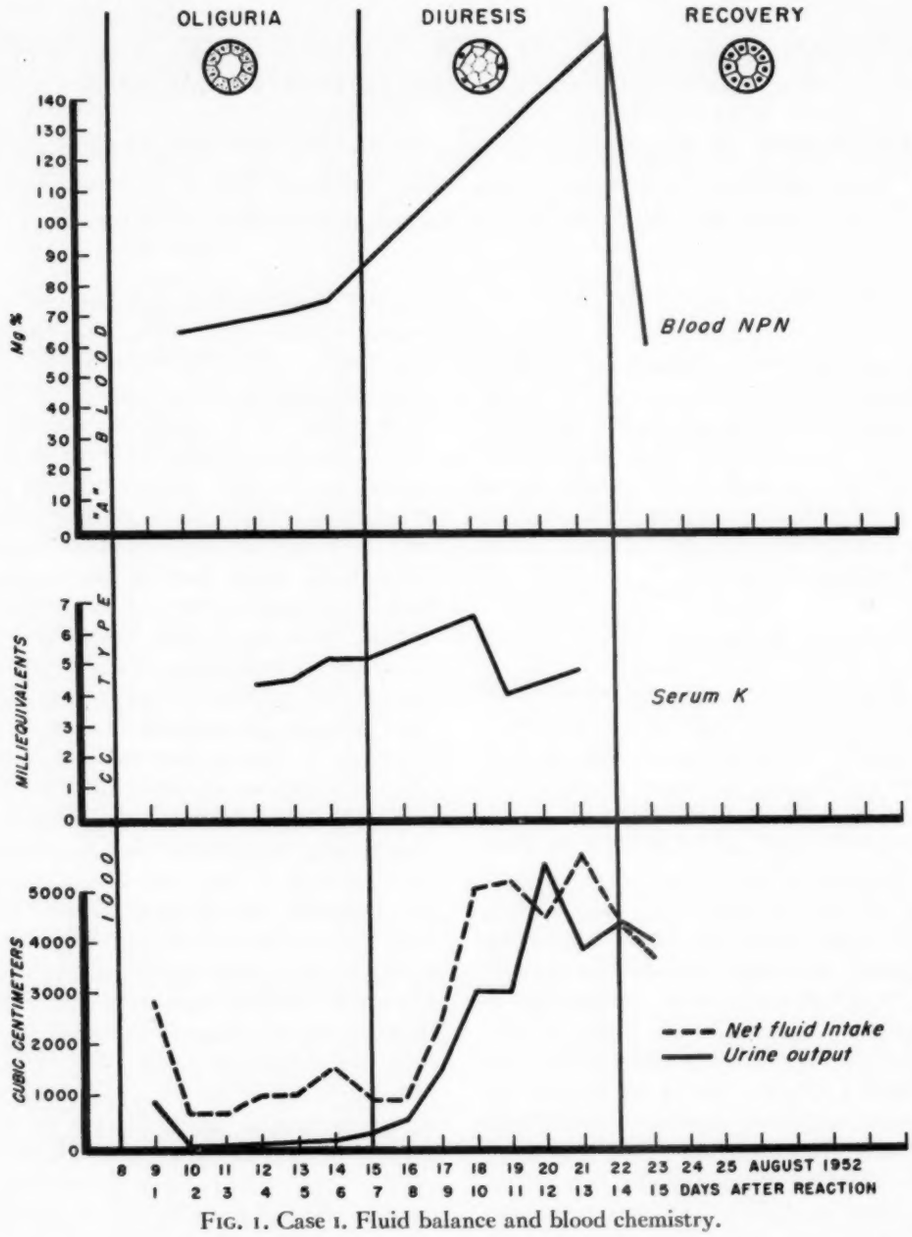

OLIGURIA
DIURESIS
RECOVERY
Mg %
"A" BLOOD
Blood NPN
MILLIEQUIVALENTS
C G TYPE
Serum K
CUBIC CENTIMETERS
1000
Net fluid Intake
Urine output
8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 AUGUST 1952
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 DAYS AFTER REACTION

FIG. 1. Case 1. Fluid balance and blood chemistry.

about 200 cc. a day. The patient improved and was returned to the United States and to the U. S. Army Hospital, Fort Belvoir, Virginia, on June 26, 1952. On arrival he was very toxic and had a septic temperature. Several hundred cubic centimeters of pus were evacuated from

twenty-four hours. He apparently had a hemolytic reaction to one or more of these transfusions, as both urine and serum became colored with free hemoglobin and urine output decreased to about 200 cc. a day. The severe infection was due to hemolytic staphylococcus

aureus resistant to all antibiotics except chloramphenicol which was given. Blood studies showed a prothrombin time which was as low as 40 per cent of normal and which did not improve with either parenteral vitamin K or vitamin K oxide. The blood clot liquefied

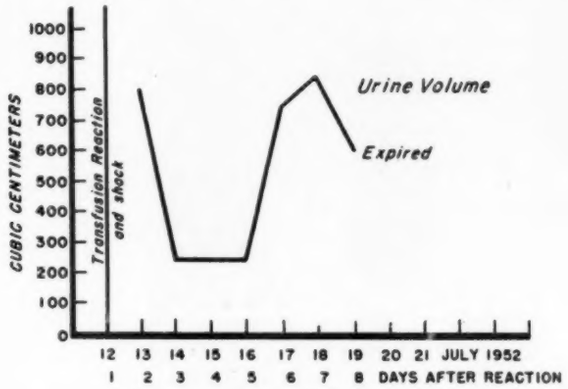


FIG. 2. Case III. Urine output.

both on the dressing and on incubation indicating presence of fibrinolysins. The patient continued to bleed, went steadily downhill and died on July 17, 1952, six days after the second transfusion reaction and period of shock. The urine output for the two days before death had risen to 800 cc. for twenty-four hours (Fig. 2) but the non-protein nitrogen had steadily risen to 245 mg. per cent. Autopsy showed lower nephron nephrosis with regeneration beginning in many of the tubules. (Fig. 3.) Using the polaroid lens many leucine and tyrosine crystals could be seen. These are frequently associated with liver damage. There was pronounced hepatocellular necrosis of the liver irregularly distributed and confined primarily to central and mid-zones of the hepatic lobules. There was congestion of the sinuses and hemosiderin deposition in Kupffer cells, fatty degeneration of surrounding hepatic cells and numerous bile casts in canaliculi. A diagnosis of toxic hepatitis was made. It was thought that infectious hepatitis could not be ruled out but was unlikely as almost no inflammation was present.

CASE IV. A twenty-eight year old white multipara was admitted at term in labor following an uneventful antepartum course. She was type O, Rh positive and had had a hemoglobin of 13 gm. in her second month of pregnancy. Serology was negative. General physical status in labor was good and blood pressure was 120/60. There was no evidence of toxemia or other abnormality. She was delivered after an

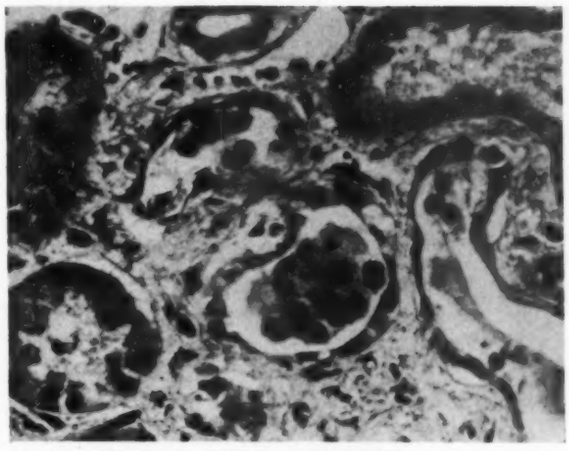
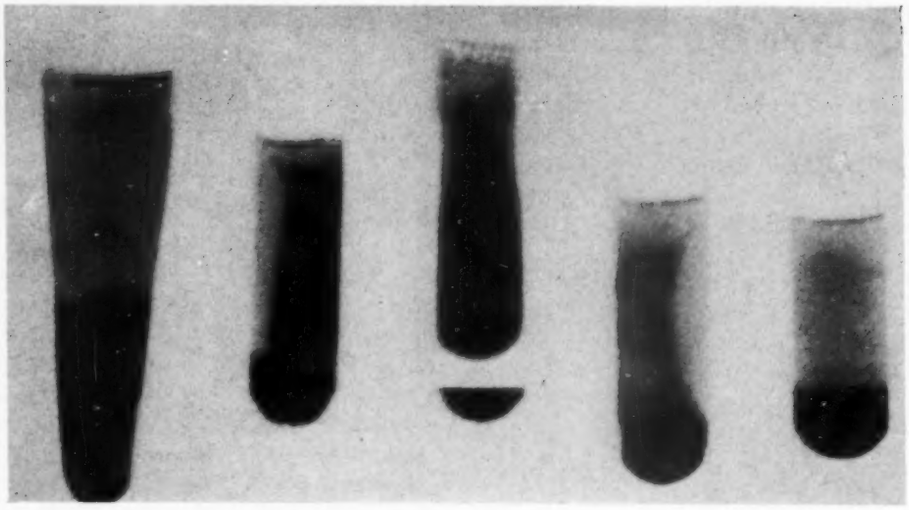


FIG. 3. Section of kidney from Case III showing necrosis of tubules with regeneration. Note flattened epithelium of regenerating tubules in the lumen of which are necrotic masses of old tubule cells.

eight-hour satisfactory labor of a 9 pound, 5 ounce infant by low forceps under pontocaine saddle block anesthesia. Because of marked perineal relaxation from prior parturition no episiotomy was performed and only a small one-degree laceration was sustained. This was repaired with complete hemostasis. Although the uterine blood loss was estimated at only about 150 cc., the uterine cavity was manually explored at the time because of its tendency to relax. No lacerations or retained fragments were encountered. During the day the patient passed several clots and the uterus felt slightly relaxed. She was given ergotrate, $\frac{1}{320}$ gr., intravenously, typed and crossmatched. The patient passed several more clots during the ensuing night; and since the hemoglobin was 7.3 gm. with 3.01 million red blood cells, a transfusion was given the next day. Aside from a sense of apprehension on the part of the patient, there was no untoward symptoms until about 300 cc. had been given when she had a slight chill and shortly vomited undigested food and blood. The transfusion was discontinued.

An immediate catheterized urine specimen showed hemolyzed blood. Within forty-five minutes she began to bleed from her gums, gastrointestinal tract (as indicated by coffee ground vomitus), uterus and kidneys (both free hemoglobin and red cells were found in the urine). A generalized hemorrhagic diathesis was recognized. A bleeding time of forty minutes with complete failure to clot was found. A diagnosis of transfusion reaction was confirmed by the identification of the administered pint



I II III IV V

FIG. 4. Photograph of coagulation tests. Tube I: Patient's blood drawn four hours after reaction showing no clotting (after two days) and hemoglobin in the plasma. Quantitative tests revealed no fibrinogen in this blood. Tube II: Mixture of normal blood and patient's blood drawn four hours after reaction. Clotting time of normal blood was four minutes. Clotting time of mixture was also four minutes. This tube was subsequently incubated for forty-eight hours with some dissolution of the clot due to fibrinolytic activity. Tube III: Patient's blood drawn eleven days after reaction. Fibrinolytic activity is evidenced by the sediment of red cells in the bottom of the tube. Clot retraction is poor because platelets are still low. Serum is free of hemoglobin. Tubes IV and V: Blood clots from Lee-White coagulation time test. Blood was drawn two hours after the first 4.2 gm. of fibrinogen were administered. Tube IV clotted in eighteen minutes and Tube V in one hour. Because the clotting time was prolonged, the red cells had a chance to settle before the clot formed. The entire contents of Tube V are clotted even though this is not evident in the photograph.

of type A blood. The immediate cause of the hemorrhagic diathesis was found to be afibrinogenemia as shown by complete lack of fibrinogen in the patient's blood with presence of fibrinolysins. Blood drawn from the patient at this time was observed for two days and failed to clot in that period of time. When normal fresh blood with a clotting time of four minutes was added to the patient's blood, the clotting time of the mixture was four minutes. This clot of combined blood was allowed to stand for forty-eight hours in the 37°C. incubator. In the first twenty-four hours a moderate but by no means complete dissolution of the clot took place. Samples of the patient's blood taken at four hours after the transfusion reaction, sixteen hours, the second day and the eleventh day all showed active fibrinolytic activity when the plasma dilution technic was employed. (Fig. 4.)

Irradiated blood fibrinogen (4.2 gm.), obtained from The Regional Red Cross Blood Center, was given within six hours of the reaction with dramatic decrease in all hemorrhagic tendencies. Since the bleeding time was five minutes and clotting time one hour, two hours after the initial fibrinogen administration another 4.2 gm. were given. Within eighteen hours the bleeding time was two minutes, thirty seconds and clotting time eleven minutes, sixteen seconds. The prothrombin time was 25 per cent of normal and the platelets had risen from a low of 18,400 before fibrinogen administration to 70,000. Table 1 graphically illustrates the course of events from this point.

Thereafter no further hemorrhagic tendencies were encountered. Blood transfusions were carefully administered over several days to restore the erythrocyte deficit. The prothrombin reached 100 per cent on the fourth day. Although fibrinogen was present after the first fibrinogen administration, some fibrinolysin could be detected as late as the eleventh day.

As shown by Table 1, the lower nephron nephrosis was handled by strict intake-output fluid balance, allowing an estimated 800 cc. daily insensible water loss, since the patient

TABLE I

LABORATORY DATA ON CASE IV

	4 hr.	10 hr.	16 hr.	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day	9th day	10th day	11th day	13th day	16th day	21st day	28th day
Fluid balance:																	
Urine	.....	.....	110	150	75	30	30	30	25	60	40	165	480	2325	3820	5075	2565
Total output cc	.....	.....	910	950	1165	830	860	900	885	1110	885	1235	1445	3125	4620	5875	3365
Total intake cc	.....	.....	2600	1300*	1100*	1000*	900*	500*	750*	750*	900*	1000*	1450†	3300†	2940†	6310†	3300†
Blood chemistry:																	
K mEq./L	.....	.....	5.0	.....	5.7	5.5	6.4	6.4	6.6	7.4	7.2	10‡	8.0‡	7.0	5.6	5.4	5.5
BUN mg. %	.....	28.2	41	57	67	71	79	77	72	82	67	75	72	90	82	40	16
Cl mEq./L	.....	.....	96.6	92.7	88	86.2	84.5	85.4	86.2	86.2	84.5	84.5	72.5	85.4	101.6	115	113
Na mEq./L	.....	.....	146	.....	142.5	135	127	130	127.5	125	135	122.5	122.5	122.5	137.5	137.5	137.5
CO_2 Vol. %	.....	.....	.....	.....	.....	.....	43	.....	.....	.....	.....	.....	49.5	39	40	36.5	53
Total Protein mg. %	.....	.....	.....	.....	.....	5.6	.....	.....	.....	.....	.....	.....	.....	5.5	6.0	6.4	7.9
Hematology:																	
Red blood cells	2.56	2.8	2.3	.....	2.0	2.2	3.3	3.1	3.3	3.6	3.9	3.3	.....	3.7	3.2	3.1	3.67
Hemoglobin	7.4	.....	6.3	.....	5.5	7.0	8.8	8.9	10.7	10.6	11.9	11.2	.....	9.9	8.4	8.0	9.0
Hematocrit	20	.....	20	.....	19	20	27	24	31	31	33	34	.....	29	25	24	28
Platelets (in thousands)	18.4	42.0	70.0	.....	44.0	70.0	108.0	152.0	86.0	84.0	130.0	134.0	.....	178.0	.....	96.0	156.0
Administration:																	
Whole blood cc	300	500	500	.....	500	500	.....	500	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fibrinogen gm	4.2	4.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Clotting factors:																	
Blood fibrinogen	0	.....	+	+	.....	.....	.....	.....	.....	.....	.....	.....	+	.....	.....	.....	.....
Blood fibrinolysin	+	.....	+	+	.....	.....	.....	.....	.....	.....	.....	.....	+	.....	.....	.....	.....
Bleeding time	40′	5′	2′30″	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Coagulation time	Never	1 hr.	11′16″	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Prothrombin % normal	.....	.....	25%	88%	.....	100%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* Intravenous 20% glucose in water.

† Oral and intravenous K and NaCl supplement.

‡ Specimens partially hemolized.

was small of stature. During this period all fluids were given intravenously as 20 per cent glucose in water by slow drip to give maximum calories to conserve body protein. By this method she received an average of 700 to 750 calories per day. The gradually increasing azotemia and hyperpotassemia never became a problem. The two serum potassium levels, 10 and 8 mEq./L., were both associated with hemolysis and thought to be in error. There was no electrocardiographic or clinical evidence of potassium toxicity. Diuresis began on the eleventh day, was well established the fourteenth day and was maximum from the eighteenth through the twenty-second day, having its crescendo on the twenty-first day. At the very outset of diuresis sodium chloride supplement was begun for the already waning sodium and chloride levels. Potassium was likewise administered by diet and parenteral supplement to prevent the anticipated hypopotassemia. The success of this plan is apparent from the restoration and maintenance of electrolyte balance which resulted. The patient was discharged clinically doing well on her thirtieth hospital day.

COMMENTS

Clinical Picture. The syndrome may start with a chill during transfusion. If the patient is under anesthesia, there may be no symptoms. The first urine is dark red with hemoglobin, as is the serum if blood is drawn and allowed to clot. There may be hemorrhage from a wound, into the skin, or from the nose, mouth or rectum. The clinical course may be divided into three stages: (1) anuria or oliguria, (2) diuresis and (3) recovery. Each of the first two stages lasts about six to ten days. The urine output falls to little or nothing by the day following the initial renal damage (stage of anuria or oliguria). The patient appears very ill and may vomit repeatedly. This picture continues for about six to ten days when urine volume gradually picks up (stage of diuresis) and may soar to great heights (6,000–8,000 cc.). This urine has a specific gravity of about 1.010 (the specific gravity of plasma). As the diuresis subsides, the urine concentrates more normally and clinical improvement is rapid (recovery stage).

Patbology. The initial lesion consists of focal areas of necrosis of tubular epithelium. These are found in all parts of the nephron. The major portion of the tubular epithelium is well preserved and exhibits no visible anatomic change. This necrosis is said to be brought about in the case of shock by an actual ischemic gangrene secondary to a violent constriction of the afferent renal arterioles.[4] This occurs as part of the normal reaction to shock whereby arterioles of less "essential" organs constrict to preserve blood for the more "essential" ones. This causes a diversion of blood from the skin and abdominal viscera, including the kidneys, to augment the blood supply of the heart and brain. If this reaction is too marked and prolonged, the renal tissue suffers. In the case of blood transfusion reaction the mechanism may be different. However, the result is the same. Microscopically the picture is a patchy necrosis of the renal tubule cells. The cells are swollen and lifeless. Other tubules may be blocked by heme casts. After tubular damage the glomerular filtrate (relatively normal in composition and volume) cannot be retained by the tubules and seeps out into the surrounding tissue like water from a leaking pipe and is reabsorbed. No filtrate remains to flow in the collecting tubules. This is the stage of anuria. After about seven days regeneration of the tubules begins. Surviving cells proliferate and line the tubules with flat, almost pavement-like epithelium. The "ghosts" of the dead tubule cells can be seen within the lumen of the new epithelium. (Fig. 3.) The new cells have little function in either absorption or excretion but do form a continuous "water-tight" tube. This is the stage of diuresis. The glomerular filtrate (still relatively normal) is little altered by the tubules in either composition or volume, and much of the entire filtrate flows through into the collecting system producing diuresis and a bast loss of electrolytes. After five to ten more days the relatively flat tubule cells mature into normal tubule epithelium and their ability to concentrate the urine returns. Water and electrolytes can again be considered. This is the stage of recovery. The urine volume drops to relatively normal levels and the urine specific gravity returns to normal.

The liver is not usually damaged, as evidenced by gross and microscopic appearance and liver function tests. However, leucine and tyrosine crystals were found in the kidneys of many patients with lower nephron nephrosis seen in the Armed Forces Institute of Pathology. Also, the finding of low or absent fibrino-

gen may possibly point to physiologic liver damage.

Pathologic Physiology. During the stage of anuria or oliguria all elements of the urine are retained. These include water, electrolytes, nitrogen, etc. Blood non-protein nitrogen and serum potassium rise. Serum potassium rises markedly because of the tissue catabolism which is an integral part of the stress syndrome occurring as a result of the operation, injury or shock. Even a small scale cellular breakdown liberates large quantities of potassium which is primarily an intracellular ion. During the stage of diuresis this picture is altered by loss of tremendous amounts of water and electrolytes. Apparently, although some non-protein nitrogen is lost in the urine in the diuretic stage, not enough is lost to compensate for its production, and its level in the blood continues to rise. Potassium is lost in large volume before the excretion of large quantities of non-protein nitrogen. The potassium which has accumulated to toxic or near toxic levels now suddenly drops and along with other electrolytes may go below normal levels unless replaced.[8] This is the crucial stage of the disease. If both fluid and electrolyte intake are not adequate, the patient may die.

Hemorrhagic Diathesis. A hemorrhagic tendency following incompatible blood transfusion has been noted by several authors. Wiener[9] called attention to the fact that not infrequently a hemorrhagic tendency develops immediately after the transfusion, and blood may ooze from the site of transfusion, from the gums, uterus (in postpartum cases) or any fresh puncture made in the skin for the purpose of treatment. Seldon[10] pointed out that patients under anesthesia develop a marked tendency toward bleeding at the operative site as one of the cardinal signs of an incompatible blood transfusion. Friesen and Nelson[2] reported seven cases of massive hemorrhage following transfusion reactions, with death as the final outcome in all but two of the cases. Transfusion reaction was implicated as the precipitating cause of the hemorrhage since all their patients were receiving blood when the bleeding began. They noted, among other things, a reduction in the circulating platelets, sudden shock out of proportion to blood loss and an occasional elevated clotting time. Such therapeutic agents as protamine, toluidine blue, human thrombin, fresh blood, vitamin K, vitamin C, antihemophilic globulin, calcium and topical thrombin were of no avail in stopping the bleeding in these cases. From these studies they concluded that no real evidence had been found as to the nature of the coagulation defect.

One of the striking features of the four cases presented herein was the development of hemorrhagic diathesis as part of the syndrome of transfusion reaction. The hemorrhages were of a minor sort in two of the cases; however, in the other two they were massive and caused the death of one of these patients. Enough laboratory data were obtained in the patients with severe hemorrhage to suggest a partial explanation of the cause of the bleeding. Both developed active fibrinolysin in the circulating blood and complete afibrinogenemia was demonstrated in the last case. In the case of the patient with the leg wound the blood was capable of forming a clot. However, the clot was unstable and dissolved in a matter of minutes after its formation. In the last case the blood was completely incoagulable and remained unclotted for two days due to complete absence of fibrinogen.* This defect was partially repaired by the injection of fibrinogen,† since this therapy reduced the coagulation time to one hour within four hours after the injection and to eleven minutes, sixteen seconds within eighteen hours after the injection. The prothrombin time was unobtainable in the initial blood sample because of the lack of fibrinogen. Platelets were greatly diminished but returned gradually toward normal within a few days after the initial depletion.

Although these observations are incomplete, they are qualitatively similar to those described by Crosby[11] in the "plasma transfusion reaction." The pattern of changes in this condition consists of a *decrease* in fibrinogen, blood platelets, coagulation time, plasma prothrombin activity and serum accelerator, with an *increase* in fibrinolytic activity of plasma, serum hemoglobin, activity of plasma prothrombin conversion factor, reticulocytes and nucleated red blood cells. These aberrations subsequently are corrected spontaneously in a matter of a few

* We wish to express appreciation to Dr. Charles C. Roby of the Boston Lying-in Hospital for these determinations.

† The fibrinogen was supplied by the Red Cross, Washington Chapter, through the kindness of Dr. Ashworth.

hours. The changes are apparently not severe enough to cause clinical hemorrhage, as was observed in the cases described in this report.

These changes are explained by the hypothesis that when the reaction takes place there is a tendency toward intravascular clotting of the blood with subsequent destruction of the intravascular clots by the activation of the circulating proteolytic enzyme, plasmin. Intravascular coagulation in incompatible blood transfusion was demonstrated by Landois[12] in 1875. He described hyaline thrombi in the vessels of the mesentery of dogs subjected to incompatible transfusion reaction. If this finding can be applied to the human cases observed clinically, a ready explanation is available for the gastrointestinal hemorrhages which they exhibit. The complete depletion of fibrinogen could also be explained, as well as the marked lowering of the platelet count. The development of increased fibrinolytic activity would appear to be a part of the body's defense against the tendency toward intravascular coagulation, since this provides a means of dissolving the clots and allowing the blood to circulate again.

The pattern of changes in the "plasma transfusion reaction" is non-specific according to Crosby[13] and has been found during anaphylactic and peptone shock, intravenous administration of foreign proteins such as tuberculin and typhoid bacilli, as well as in incompatible transfusion reaction. It has been described as the colloidoclastic or hemoclastic reaction.

Whether or not clinical hemorrhage occurs may depend on several factors such as the severity of the reaction (namely, the degree of fibrinogen loss or fibrinolysin activation), the presence of severed blood vessels as in an open wound or postpartum uterus, and perhaps individual susceptibility.

It is of some interest to compare the hemorrhagic diathesis occurring in these transfusion reactions with those seen in premature separation of the placenta, intrauterine fetal death and amniotic fluid embolization.[14–17] In all these syndromes afibrinogenemia and active fibrinolysin of the circulating blood appear to be responsible for the hemorrhage.

It is also of interest to compare the hemolytic phase of the incompatible transfusion reaction with that of the plasma transfusion reaction in patients with paroxysmal nocturnal hemoglobinuria. In the latter Crosby has demonstrated that a tendency toward coagulation takes place along with the hemolytic episode. The mechanism of the hemolysis has been explained on the basis of increased susceptibility of the patient's red blood cells to a proteolytic enzyme in the blood. In incompatible transfusion reaction there is the same combination of events, namely, hemolysis and the tendency toward intravascular coagulation. It may be that in this reaction, also, a proteolytic enzyme is involved in the hemolytic process as well as in the coagulation portion of the reaction.

Treatment. Before the lower nephron nephrosis actually has demonstrated itself, it is possible that damage to the tubules may be lessened in the case of transfusion reaction by diluting the urine with large quantities of fluid and alkalinization of the urine with sodium lactate. However, once urine output falls this is fruitless. An accurate fluid intake and output record to be totaled at least every twelve hours should be maintained. Fluid intake should be limited to correspond to only the insensible loss (600 to 1,000 cc. for twenty-four hours) plus the urine volume and other loss (vomitus, etc). The rise in blood non-protein nitrogen and serum potassium may be slowed by the protein-sparing action of the administration of large amounts of carbohydrates and fats orally if possible by feeding butter, honey, etc.; or, as is usually the case because of nausea, carbohydrate must be given intravenously by means of glucose in water (20 per cent in water may be given slowly with no ill effects) or possibly better by invert sugar (a mixture of glucose and fructose).[5–7] Fructose is metabolized much more rapidly and when available commercially may be best. This enables large amounts of carbohydrate to be administered with relatively little fluid. Only if serum potassium reaches near toxic levels (which has not occurred in any of our cases) will use of an artificial kidney be required. During the stage of anuria little saline is lost and none need be given. When the stage of diuresis starts, not only the urine volume must be accurately measured but also the loss of electrolytes which takes place quickly. Daily determination of blood and urine levels of potassium, sodium, chlorides, CO_2 and non-protein nitrogen should be done. Serum potassium which has risen from a normal of 4 mEq. up to near toxic levels of 8 or 10 may suddenly fall to below normal levels. Serum sodium, chlorides, potassium and

other electrolytes also fall and must be maintained. Although the blood non-protein nitrogen continues to rise, this is of no great consequence. The treatment of the bleeding tendency is probably the administration of fibrinogen. The question of additional blood transfusion is problematic. Additional blood is desirable to replace that lost by hemolysis and other causes. However, many of these patients are very difficult to cross-match, particularly after a transfusion reaction. Therefore, unless the need for blood is great, it is probably best not to transfuse again and run the risk of a second reaction. After approximately two to three weeks the initial renal damage recovery occurs, with diminution in the urinary output and fall in the urea nitrogen.

CONCLUSIONS

1. Lower nephron nephrosis requires the closest observation and detailed treatment to permit recovery.

2. Hemorrhage occurred in all four cases and may be a major problem. All clotting elements were affected. However, in two cases studied there was fibrinolysin activity, and in at least one case complete afibrinogenemia. Fibrinogen corrected the condition in the one case to which it was given. Depletion of all blood-clotting elements is probably indicative of intravascular clotting with resultant using up of clotting elements. Activation of fibrinolysin may occur in the body's attempt to stop this process. It is conceivable that the intravascular clotting is more responsible for necrosis of the tubules in lower nephron nephrosis than vascular spasm.

3. Recovery, if it occurs, is complete.

4. Principal treatment consists of proper fluid intake; proper electrolyte replacement; high carbohydrate, high fat, low protein intake; fibrinogen if hemorrhage is a problem.

5. Properly treated, most patients with lower nephron nephrosis will recover without benefit of more elaborate methods such as the artificial kidney, peritoneal lavage, etc.

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Osteopetrosis

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THE rarity of osteopetrosis prompts the report of two cases, especially since the malady in these cases was mild. This emphasizes the fact that although this disease is severe and even rapidly fatal in some cases, in others it produces few disturbances and, with no or brief periods of morbidity, permits a relatively long and normal life.

The existence of abnormal sclerosis of bone was recognized in the latter part of the nineteenth century;[1] but its first description as a disease entity was made in 1904 by Albers-Schönberg,[2] a roentgenologist. He reported three cases in which there was a triad of symptoms which he considered pathognomonic and diagnostic. These were generalized osteosclerosis, anemia and lymphadenopathy, including enlargement of the liver and spleen. In 1907[3] he added seven more cases with a similar clinical picture focusing attention on a specific disease which has since acquired the eponym of Albers-Schönberg disease. Subsequently additional cases were periodically recorded so that by 1950[4] the literature contained a total of 156 instances of osteopetrosis. Since then Cohen and Callender and Miyakawa have reported two cases to which I add two more.

The disease has many synonyms, all including terms indicative of the main pathologic alteration, namely, generalized sclerosis of the bones. Thus we find, among others, the following titles: Marmorknochen, marmor skelett, marble bones, chalky bones, congenital osteosclerosis,[35] osteosclerosis fragilitas generalisata, osteosclerotic anemia and osteopetrosis. The last term was coined by Karschner[5] in 1926, and is likely to remain the most frequently used.

Osteopetrosis has some characteristic features and a few pathognomonic objective signs so that its recognition is now relatively easy. The disease affects Caucasians and Negroes,[6] is geographically widespread, occurs about equally in both sexes and has been found at all ages from the prenatal period[7] through infancy[34] and childhood to the eighth decade of life.[8,9]

Osteopetrosis may exist in all stages from mild to very severe. Generally there are two types, namely, the severe or malignant form which occurs almost exclusively in infants, and the mild form which is found in children and adults. The common finding in all cases is sclerosis of the bones. The earlier the osteosclerosis appears and the more profound and extensive its involvement of the bones, the greater will be the secondary symptoms, such as, anemia, malnutrition, blindness, dental caries, osteomyelitis, a lack of resistance to infections and intercurrent disease, and hence the greater the morbidity and likelihood of an early fatal termination. Conversely, the less marked the degree and distribution of the osteosclerosis the milder and fewer the complications. In this group fractures require treatment more often than any other single symptom. In at least two cases the disease was not discovered until the patient was seventy-two years old.[9,33] It should be emphasized that the earliest cases as well as many in recent years came to light through routine diagnostic roentgenography for a variety of lesions.

Osteopetrosis is seemingly a disturbance in the development[10,11] or the metabolism[12] of bone, or both, of unknown origin. Statistical studies point out that in many cases the disease is definitely familial. Clairmont and Schinz,[13] Pirie,[14] Higinbotham[15] and Kelley[16] each reported instances of four cases in one family. Brown, in a discussion of a paper by Smith and Smith,[17] reports six cases in one family. The disease is also known to be hereditary. McPeak[9] reported eight cases in three generations of one family. Riser[18] is authority for the report by Sick in 1914 of three siblings and one cousin with osteopetrosis. Consanguinity of the parents has been found in a sufficiently large percentage to suggest the transmission of a mendelian germinal factor as evidence of the ill effects of inbreeding.[19,20] According to Pines and Lederer[8] a familial history or consanguinity was found in forty-nine of 121 cases of osteopetrosis. However, although the etiology of this

disease is undetermined, its clinical manifestations are clear-cut and generally unequivocal, and the elements of appropriate treatment are well defined.

Malignant Type. The typical case is found in an infant or child varying in age from several months to two or three years.[21] The child is anemic and undernourished; the condition may resemble rickets[22] with which, in fact, osteopetrosis is often associated. The physical[5] and even the mental development may be conspicuously retarded. The child may have or have had a fracture of some of the long bones. Vision is defective or the child may actually be blind.[23] There may be partial or marked deafness. Defective dentition is very common, and there may be early caries of the teeth leading to osteomyelitis of the maxilla or mandible.[24,25] Frequently general adenopathy and enlargement of the liver and spleen are present, but they are certainly not constant features of the disease. Occasionally one sees a hydrocephalus.[29,27] Roentgenography discloses an extensive process of homogeneous thickening of the bones throughout the entire skeleton, with deformity of the extremities such as bowing of the thighs and legs, coxa vara, clubbing of the ends of the long bones, especially the proximal extremities of the humeri, and the adjacent extremities of the femora and tibias, sclerosis of the base of the skull, and reduction and poor delineation of the marrow cavities. The degree of osteosclerosis varies in different bones, but is fairly equal and symmetric in the extremities. The effect of the osteosclerosis is threefold: (1) it invades and reduces the bone marrow tissue thus diminishing its hematopoiesis with resultant anemia, malnutrition and generally lowered resistance; (2) it invades and reduces the size of the various cranial foramina causing optic atrophy, defective function or even complete loss of function of the olfactory, facial[28] and other cranial nerves; and (3) the increase in the mineralization of the bones by an excessive content of inorganic salts makes the bones brittle and subject to frequent fractures from relatively minor traumas. These patients have a lowered vitality so that many of them early succumb to some intercurrent infection such as pneumonia.

Mild Form. This type is seen predominantly in children between five and fifteen years of age and in adults at any age. The symptoms of the disease are the same as in the malignant form but the degree is greatly diminished. In this group the most common complaint is likely to be fracture of a long bone.[31] The fractures, resulting often from simple injuries, may heal promptly or the healing may be delayed a short or a long time.[32] A very frequent symptom is osteomyelitis of the maxilla or mandible due to carious teeth, with persistent and exhausting suppuration. In one instance the whole mandible was extruded.[29] In some cases there is hypertrophy and overdevelopment of the mandible leading to prognathism. One report[15] cites such an occurrence in four siblings. An anemia of moderate grade is usually present, the hemoglobin content and the number of the red blood cells varying between 50 and 75 per cent of the normal. In some instances the hemoglobin may be entirely normal, and at the other extreme, as in one reported case, the hemoglobin may be reduced to 10 per cent.[23] The most important and pathognomonic finding is a generalized osteosclerosis. The sclerosis may involve some, many or all of the bones, and its severity varies in different bones. The bones most commonly affected are those at the base of the skull, in the pelvis and the extremities. Some bones, as the metacarpals and metatarsals, may escape the disease, their roentgenograms appearing normal. Secondary deformities such as bowlegs, coxa vara and scoliosis are relatively frequent. Most of the complications are explicable on the basis of disturbed osseous development. Hydrocephalus is assumed to result from the interference with the free flow of the cerebrospinal fluid by the osteosclerosis at the base of the skull, especially at the foramen magnum. The lymph nodes and the liver and spleen may or may not be enlarged. In this category belong adults in whom the anamnesis reveals an onset of the disease in infancy or childhood with poor dentition, deafness and diminished vision, indicating that the appearance of this malady early in life does not necessarily preclude reasonable longevity.

In between the mild and severe forms are found all gradations of the disease but always with the dominant and constant finding of a more or less generalized osteosclerosis.

Blood. The primary change in the blood is a reduction in the number of red blood cells and in the hemoglobin content. There is no significant alteration in the white blood cells (unless, as occasionally happens, there is an

1 2

FIG. 1. Roentgenogram of left upper femur and left side of pelvis. Fracture is evident. Note uniform sclerosis of the femur, ilium, pubis and ischium without alteration in the size or shape of these bones, or alteration in the articular surface of the femoral head or the periosteum of any of the bones. Note thickening of cortex, replacement of cancellous bone by compact bone and reduction in the width of the marrow cavity.

FIG. 2. Right femur showing marked thickening of cortex, narrowing of marrow cavity but no alteration in size or shape of the bone or involvement of periosteum.

associated leukemia) or blood platelets. The serum calcium, phosphorus and the alkaline phosphatase are all within normal limits. Other laboratory tests, as urinalysis, are negative.

Bones. The essential, specific and pathognomonic change in the bones is a homogeneous thickening without alteration of the length, size or general conformation. The cortex and spongiosa are sclerosed through an increase in the number and thickness of the trabeculae with an invasion and a varying degree of obliteration of the marrow cavity. The periosteum, articular outlines and articular cartilage are not affected. Exceptionally, as at the site of a fracture, there may be some periosteal new bone formation which is not inherent in the disease. The pathologic process in the long bones is a disturbance of the endochondral and endosteal function of bone formation. In infants the disturbed bone development is manifested by a club-like thickening of the metaphyses and a deficient or a complete lack of absorption of the endosteal trabeculae, so that there is little or no marrow cavity. The primary osteochondral complex shows much osteoblastic activity with extension of the cartilaginous matrix and osteoid toward the diaphysis, and very little osteoclasis. Transverse and vertical lines, zones or areas of radiolucency alternating with radiopacity may be seen in the metaphyses. These areas probably represent arrest and progress in the pathologic process of osteosclerosis. In some bones, notably the iliac and carpal bones, one may find concentric zones of osteosclerosis. This has been shown in many illustrations but in none quite as well as in those published by Callender and Miyakawa.[3]

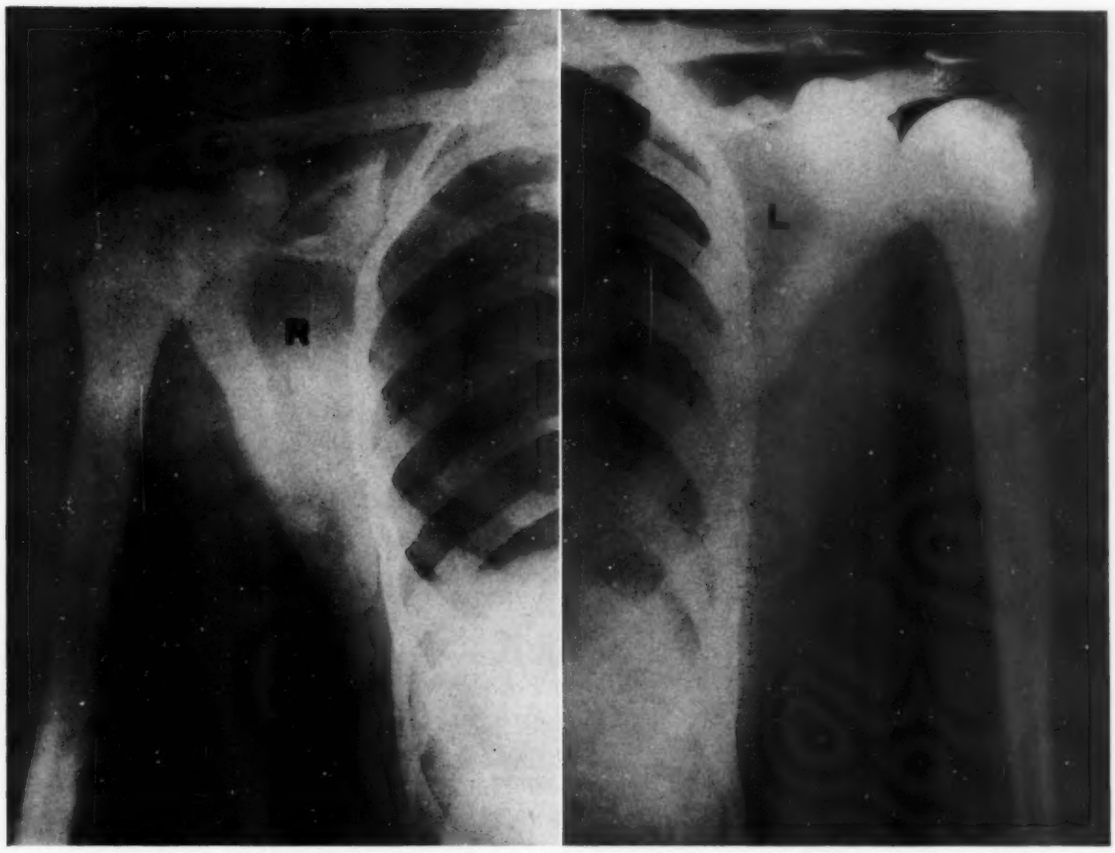

FIG. 3. Roentgenogram of both humeri including the corresponding scapula, clavicle and part of the thoracic cage. There is thickening of the cortex of each humerus as well as the glenoid process and axillary border of each scapula. The upper metaphysis in each humerus shows increased density in structure and loss of definition between cancellous and cortical bone. The marrow cavity is preserved but reduced in width. The clavicle and ribs show almost no change.

The periosteum and the epiphyses are not affected so that neither the length, width nor remodeling process of the long bones is disturbed. In the flat or membranous bones there is an increase in the bone trabeculae with a reduction of the marrow spaces and tissue, and again no abnormal periosteal activity. In the calvarium the diploe became conspicuous by their absence.

Complications of the pathologic bone process are fairly numerous. In the long bones one sees fractures, bowing of the femora and tibias, and coxa vera. Structural scoliosis is a frequent occurrence. In the skull the chief effect of the sclerosis is invasion of the foramina and pressure atrophy of some of the cranial nerves, with resultant defective or complete loss of function. The various air pockets in the skull, as the frontal and maxillary sinuses and the mastoid cells, may be partially or completely obliterated.

Chief Complaint. The symptoms which lead to investigation and a diagnosis of osteopetrosis vary a great deal. One of the most common, especially in an older child or adult, is the occurrence of a fracture and the roentgenographic finding of abnormal bone structure in the injured limb as well as elsewhere in the body. This often has lead to the study and radiography of the other members of the family, with the discovery of additional instances of osteopetrosis in sisters, brothers, parents or other relatives with no symptoms or very few signs of the disease. In infants and children the lack of normal physical or mental development, malnutrition or deficient dentition may lead to a recognition of this malady. Sometimes what appears to be a familial characteristic, as prognathism, guides one to the identification of the real disorder. A frequent lead symptom is failing eyesight and nystagmus.[22] Enlargement of the head,[30] headache[10] and difficulty

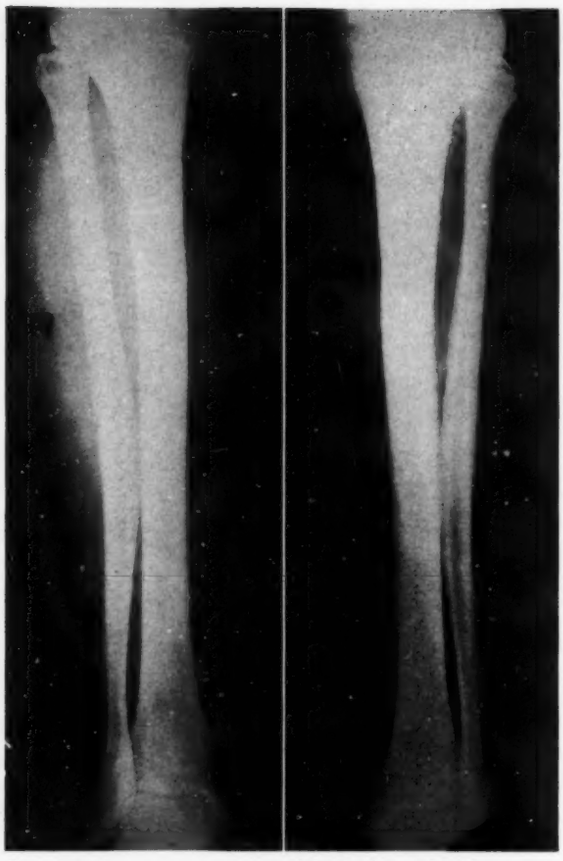

FIG. 4. Roentgenograms of both legs showing generalized osteosclerosis. No involvement of articular extremities, articular surfaces or the periosteum.

in swallowing[31] have also been responsible for the discovery of osteopetrosis.

Pathogenesis. The exact etiology is unknown. Its pathogenesis is assumed by most observers to be a congenital anomaly of bone development as the accidental but primary lesion with all the other symptoms as fractures, anemia and functional disturbances of the cranial nerves as secondary. Furthermore the anemia leads to malnutrition, physical underdevelopment and poor resistance to infections as osteomyelitis and respiratory diseases as pneumonia. Fractures may be followed by deformities, although some deformities as coxa vara and bowing of thighs or legs may appear without antecedent fractures. The invasion of the cranial foramina and their contained nerves gives rise to nystagmus, disturbed vision or even blindness, partial or total deafness and facial palsy. On the other hand some observers believe that the primary lesion is an endocrine disturbance with the various clinical manifestations as secondary. The latter theory is entertained by only a few since it seems less plausible than the first view which emphasizes the congenital anomalous and abnormal development of the bony tissue which is in line with the frequent finding of other anomalous congenital lesions.

In speaking of pathogenesis Pines and Lederer[5] state: "The histomorphologic changes —in the bones—appear to support the theory that marble bones is a disease of the primitive osseomedullary anlage. The clinical and anatomical variations of the disease are apparently contingent upon the degree of involvement of each of the elements upon whose integrated growth and development depends the structure of the skeleton. It would appear that when the sclerogenous elements are predominantly involved, the disease takes a slow, benign clinical course even though the structure of the bones is greatly altered. When the myelogenous mesenchyme is seriously affected, as is the case in many of the infantile forms of the disease, the course is malignant and rapidly fatal."

Association of Osteopetrosis with Other Diseases. Clinical experience gives ample evidence of the accidental association of two or more diseases. A number of instances have been reported in which another disease has been superimposed on the osteopetrosis, notably leukemia,[1] Hodgkin's disease,[37] sarcoma,[36] coarctation of the aorta[38] and rickets.[34] In none of the reported cases does there seem to be any relationship between the two diseases other than an accidental association.

CASE REPORTS

CASE 1. A. T., a thirty-five year old man, came under my care on November 19, 1951. On the previous day he had fallen down a flight of steps, injuring the left thigh and right shoulder. He was totally disabled from an evident fracture of the left femur. The patient's history prior to the accident was completely negative. He had always been well so far as he knew. He had no symptoms referable to any of his body systems. Specifically he had no malnutrition, diseased teeth or defective vision or hearing. He did not fatigue easily; in fact most of the time he was engaged in relatively hard physical work as proprietor of a grocery store. He was married and had four children, all of whom were well. He had not been related

FIG. 5. Skull shows slight sclerosis of the basal bones. The upper cervical vertebrae are involved in a fairly marked sclerotic process.

to his wife before their marriage. The family history was negative for any blood dyscrasia or bone dystrophies.

The patient appeared in good general condition. He was muscular and rather overweight. There was a fracture of the left femur in the upper third. A roentgenogram (Fig. 1) revealed a subtrochanteric fracture of the femur with moderate overriding of the fragments. What was remarkable and immediately obvious was the existence of a homogeneous sclerosis of the femur. The film included the left side of the pelvis and exhibited a homogeneous sclerosis of the innominate bone. In the course of our observations the patient's entire skeleton was x-rayed. The entire left or fractured femur showed sclerosis; the cortex occupied about two-thirds of the width of the bone with, however, a patent though narrowed marrow cavity. The ends of the femur, articular cartilages and periosteum were not affected. There had apparently been no deformity of this bone prior to the fracture. The right femur (Fig. 2) showed a similar homogeneous sclerosis with partial reduction in the diameter of the marrow cavity but no involvement of the articular surfaces and no deformity of the neck or shaft of the femur. Both humeri (Fig. 3) showed the same type of sclerosis as the femora. They were not deformed; the marrow cavity was reduced in size but patent; the periosteum and the articular cartilages were not altered. The lesion in the thighs and arms was symmetric in character, distribution and degree. The forearms showed a mild sclerosis of the bones with the marrow cavities only slightly invaded. The hands seemed normal. The legs (Fig. 4) showed an increase in the thickness of the cortical bone, more in the tibias than in the fibulas, but with retention of a narrowed but clearly seen marrow cavity in each bone. The skull appeared normal (Fig. 5) except for very slight sclerosis at the base. The feet (Fig. 6) were slightly affected. The vertebrae (Fig. 7) showed a very marked degree of sclerosis which peculiarly affected the periphery of the vertebral body, especially the superior and inferior surfaces with the center of the body exhibiting seemingly normal cancellous bone. The proximal portions of all the ribs were sclerotic while the shafts of the ribs, if affected, were only mildly so.

The osteosclerosis in this patient affected

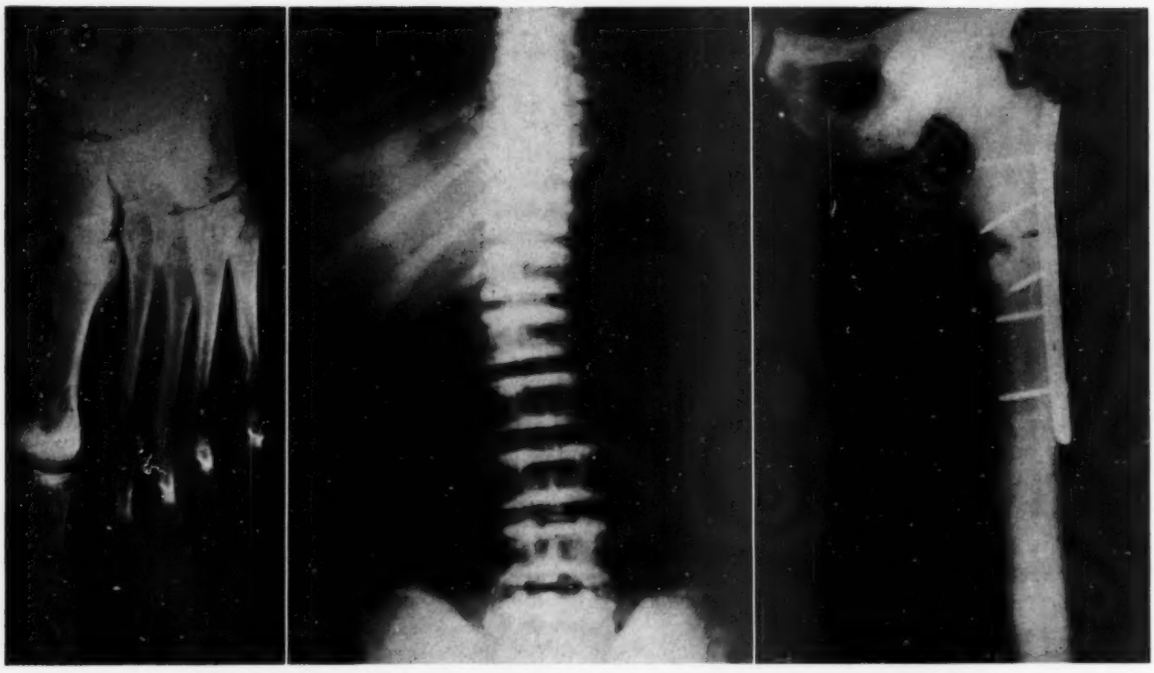

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FIG. 6. Left foot. There is a mild increase in the cortical bone; cancellous bone is not altered. There is some periosteal thickening and new bone formation along the shafts of the second, third and fourth metatarsals. Same condition in right foot.

FIG. 7. Roentgenogram of spine showing characteristic increase in the density of the bone at the superior and inferior vertebral body surfaces with fairly normal intervening cancellous tissue. There is a moderate sclerosis at the costovertebral junctions.

FIG. 8. Postoperative roentgenogram. Shows the metal plate well approximated to femoral fragments with five screws. Cancellous and cortical bank bone were used to favor osteogenesis and healing. The cancellous bone was packed about the fracture. Two cortical grafts were applied as onlay grafts; only one is visualized in this film.

chiefly the pelvis, both femora and humeri, the vertebrae and the vertebral portions of the ribs. The other bones and especially those of the skull were not involved at all or only to a slight degree. In none of the bones was the marrow cavity obliterated.

The rest of the physical examination was negative. There was no enlargement of the liver, spleen or lymph glands. Blood examination showed a hemoglobin of 13.6 gm.; the red blood cell count was 4,200,000 and the white blood cell count 8,200, with a normal differential count; the serum calcium was 9.5 mg. per cent, the non-protein nitrogen was 29, the blood sugar 108, the serum phosphorus was 4.0 mg. per cent, the alkaline phosphatase gave a reading of 2.9 to 3.8 Bodansky units, all within normal limits. The sedimentation rate was[45] mm. which was high. The Kline test was negative. Basal metabolism test was plus 20. A blood examination made some fifteen months after the first test showed 14.6 gm. of hemoglobin, red blood cells 4,480,000 and white blood cells 8,200.

So far as the fracture of the left femur was concerned, I decided to do an open reduction and immobilization of the fracture by a blade-plate and screws. The operation was performed on November 21, 1951, under general anesthesia. The fracture was exposed through a vertical incision over the lateral aspect of the hip and thigh. The fragments were readily brought into end-to-end apposition. Since the fracture was only one and a half inches below the lesser trochanter it seemed wise to use a blade plate instead of a simple plate. The surface of the bone appeared fairly normal. The femoral fragments showed no marrow cavity. Where there should have been a marrow space, there was a very dense bone, not as impenetrable as the cortex, but not of the nature of cancellous, spongy bone. An attempt was made to insert the blade of a blade plate into the femoral neck and head. Despite vigor-

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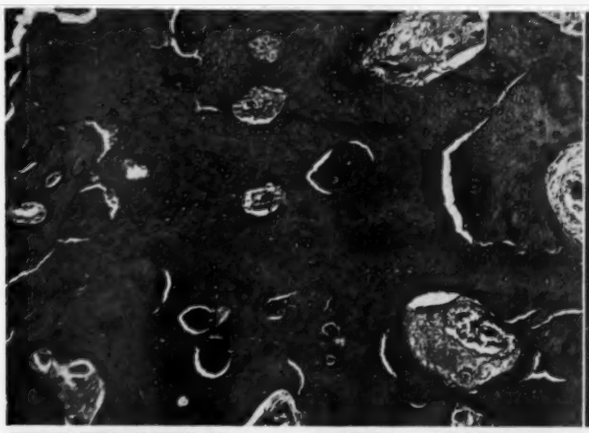

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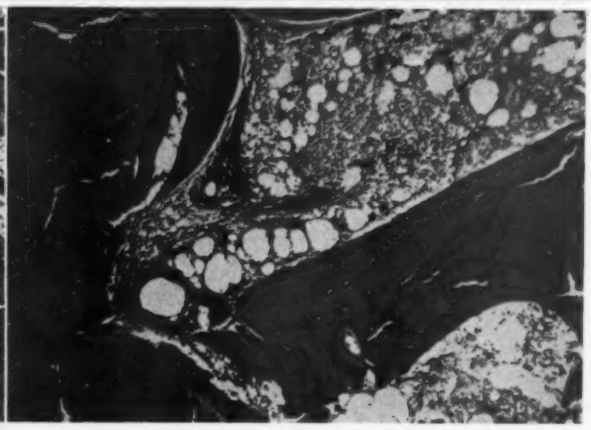

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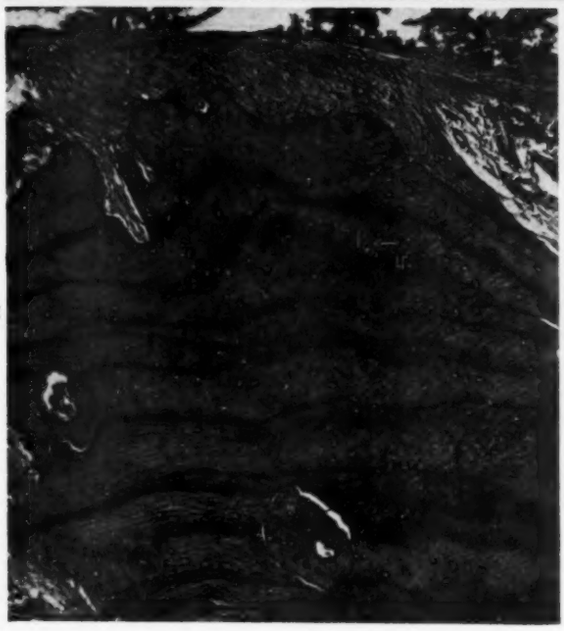


FIG. 9. Photomicrograph showing cortex lower down than in section in Figure 11. The haversian systems are sparse with an unusually large amount of interstitial lamellar bone. Many of the haversian canals are small and appear almost as if they were being obliterated. However, some of the haversian spaces are quite large. × 50.

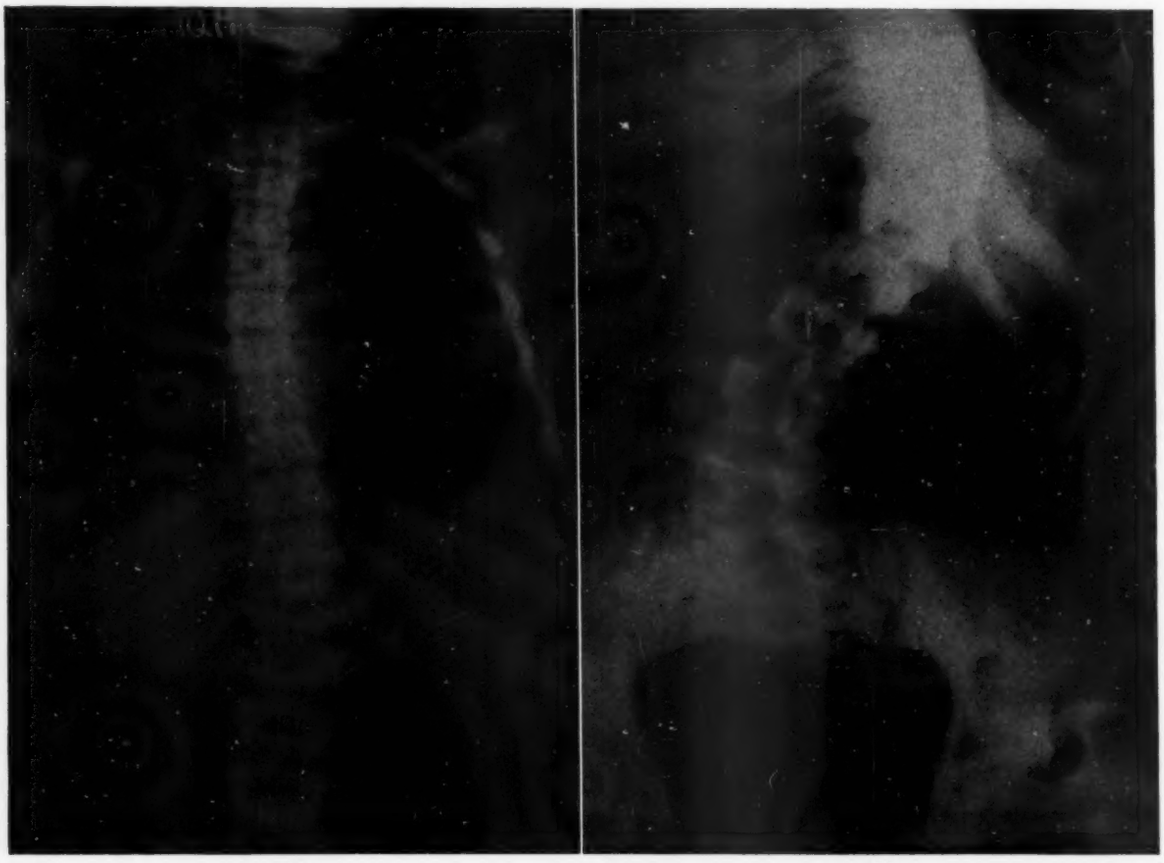
FIG. 10. Photomicrograph. Spongy bone showing thick trabeculae with numerous cement lines creating a mosaic pattern as evidence of reconstruction. × 55.

FIG. 11. Photomicrograph shows outer zone of cortex. The periosteum is a clearly definable cellular fibrous membrane. Note unusually wide zone of outer ground lamellae and paucity of haversian canals. × 45.

ous efforts to drive the blade into the bone it was impossible to do so because of the hardness of the bone. This was no "chalky" bone such as Pirie described in his cases. The blade part was then broken off with bending irons and the plate segment applied to the side of the femur as shown in Figure 8. An electric drill was used to create the channels for the screws; even the drill penetrated with some difficulty. In line with my findings Henderson, quoted by Pirie, stated: "In the cases operated on the bones are so hard that they break the edge of the chisel or the drills." The plate was finally fixed with five screws and appeared to hold satisfactorily. There was a small gap between the ends of the fragments; this was filled in with homologous bone from our bone bank, and in addition two cortical bone grafts were affixed to the outer surface of the femur, bridging the fracture, as a further guarantee of healing.

Segments of bone had been removed from the operated area for histologic study. The character of the bone structure in the cortex and in the interior of the bone is shown in Figures 9, 10 and 11.

The healing of the fracture has been greatly delayed despite adequate immobilization. When seen fifteen months after the operation, the fracture was for the first time clinically and roentgenographically definitely healed. Nevertheless when in recent months I permitted the patient some weight bearing, since the limb was supported in a long leg brace with thoracic band, the metal plate inserted into the femur broke and some angulation of the fragments took place. However, there is no external de-



12A 12B

FIG. 12. A, shows spine in 1933. Note scoliosis and sclerosis of the vertebrae, especially at the superior and inferior surfaces. The ribs are also affected. B, the spine in 1939. The scoliosis and sclerosis of the vertebrae have markedly increased. Note the osteosclerosis of the entire pelvis.

formity of the limb, no pain on motion and the patient is able to maneuver the limb and bear weight on it in standing and walking without any discomfort.

Comment. This case is undoubtedly one of osteopetros s since there is an extensive osteosclerosis of a homogeneous nature involving many bones. I belongs in the mild category of osteopetrosis since there has been no deterioration of health, no anemia, osteomyelitis or invasion of the cranial nerves. It is unusual in that there has been a very long delay in the healing of a simple fracture despite seemingly adequate immobilization.

CASE II. N. K., a sixteen year old boy, came under my care on March 5, 1933, for bilateral bowlegs and a short stature. His past history was entirely negative. He had had no serious illnesses or injuries. His parents, three brothers and two sisters were living and well.

The boy was only 4 feet 3 inches in height. He walked with a swagger gait. His trunk was short and he had a mild right dorsal, left lumbar scoliosis. The upper limbs appeared normal, but in the lower limbs he had a bilateral anterolateral bowing of the thighs and bilateral bowing of his legs.

Roentgenograms were made of his entire skeleton and showed the following changes: *Skull:* The calvarium was normal; at the base were several areas of marked sclerosis. *Spine:* There was a mild right dorsal left lumbar structural scoliosis. The vertebrae exhibited marked sclerosis of the cortical bone, especially at the upper and lower surfaces, with the central portion radiolucent. There was sclerosis of all of the ribs. (Fig. 12A.) *Pelvis:* Sclerosis of all the bones was noted. (Fig. 12B.) *Upper limbs:* There was osteosclerosis (Fig. 13) involving the upper parts of both humeri, the upper extremities of both radii and ulnas and also, to some degree, the carpals and metacarpals. The lower extremities of the bones of the arms and forear ms were not affected, and the marrow

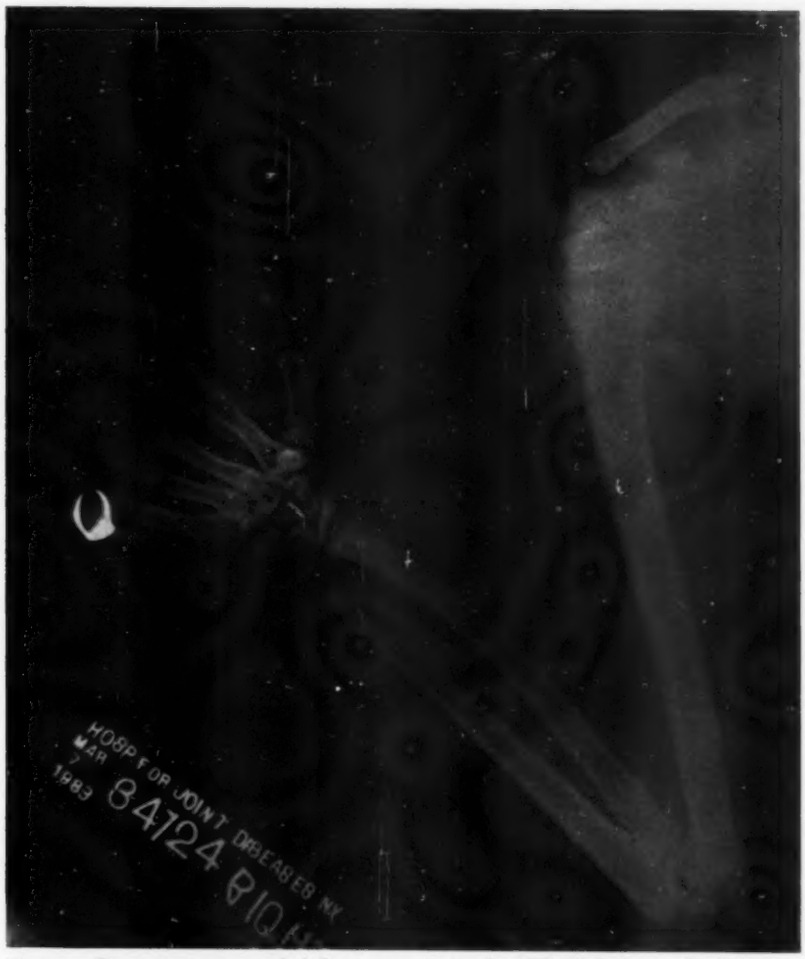


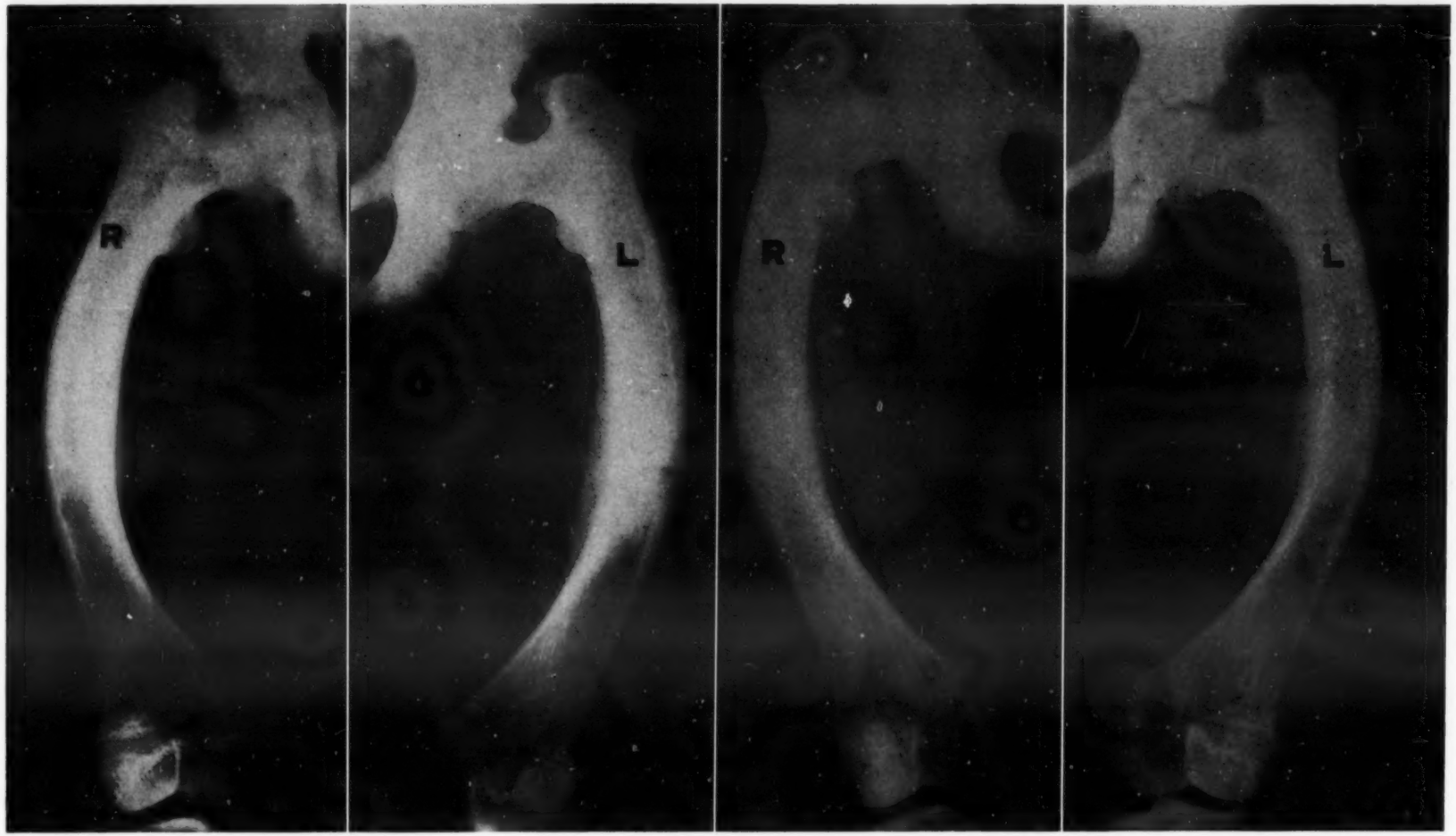
FIG. 13. Roentgenogram of right upper extremity. The left upper limb gave a similar appearance. Note sclerosis of upper part of humerus, radius and ulna. Marrow cavities of normal size.

cavities were clearly visualized and evidently not invaded by the osteosclerosis. *Lower limbs:* There was marked symmetric outward bowing of both femora with extensive sclerosis but no obliteration of the marrow cavities. There was a severe bilateral deformity of the coxa vara. (Fig. 14.) In later roentgenograms (Fig. 15) each femur presented a transverse line of radiolucency that extended from without through the cortex and half way across the thickness of the femur. This zone had the appearance of a fracture, but when an osteotomy was done on the right femur to correct its bowing, a fracture was not found confirming the opinion that the rarefied zone did not represent any break in the continuity of the bone. In the tibias there was marked sclerosis in the upper extremities and in the lower metaphyses. The epiphyses were still open. There was some osteosclerosis of the tarsal and metatarsal bones.

The dental and general physical examination was negative. The urinalysis was negative as was the Wassermann test. The blood findings were within normal limits. There were 4.6 million red blood cells, the hemoglobin was 90 per cent and the white cell count was 6,000.

The bowing of the legs was corrected by open osteotomy which healed rapidly. The tissue removed at the time of osteotomy for histologic study showed "an osteosclerosis, possibly of the Albers-Schönberg type."

The patient remained under observation and was seen many times. In April, 1939, six years after he first came under our care, he applied for correction of the bowing of the thigh. At this time he was markedly dwarfed in stature. Although twenty-two years old he



14 15

FIG. 14. Both femora in 1933. Note coxa vara, marked outward bowing, thickening of cortex, some periosteal new bone on concave side of bowing, retention of marrow cavity.

FIG. 15. Both femora in 1939. Deformities and osteosclerosis are well shown. In each femur there is seemingly an infraction of the shaft. At operation on right femur for correction of the bowing, a fracture was not found. The apparent infraction was simply a zone of radiolucency.

was only 4 feet 7 inches in height. The scoliosis had markedly increased. (Fig. 12B.) General physical examination was negative. Specifically he had no visual or auditory defect. His teeth were in good condition, and his heart, lungs and abdomen were normal. The skeletal changes were most marked in the spine, ribs, pelvis and femora.

On April 14, 1939, an open osteotomy of the right femur was performed. The area of infraction seen in the roentgenogram was completely removed. On pathologic examination it was found to be a tract in which there was rarefaction and decalcification extending through the cortex, but there was no actual break in the continuity of the osseous tissue. (Fig. 15.) The osteotomy of the femur corrected the bowing and healed rapidly.

It is interesting to note that not only did this patient not have an anemia but also on the contrary had a high hemoglobin and red blood cell count as follows:

Date	Hemoglobin (gm.)	Red Blood Cells
April, 1939	15.4	5,280,000
July 13, 1939	17.0	6,100,000
July 15, 1939	17.0	6,400,000
October 25, 1939	16.4	5,400,000

The white blood cell count varied between 4,300 and 8,900. The blood calcium and phosphorus were normal.

Subsequently this patient did well until 1946 when he sustained a fracture of the left femur. This was treated by plating, and healed well.

Comment. This patient, as the previous one, belongs in the category of mild osteopetrosis, mild because his life had not been threatened or shortened by the disease. But the disease was complicated by marked deformity of the spine and lower limbs causing dwarfing of his stature. The roentgenograms and the histopathologic findings, as well as the appearance of the bones at operation, confirm the diagnosis. The marrow cavities were invaded but not to a degree to disturb hemopoiesis. In fact he had an abnormally high red blood cell count and a high hemoglobin content.

SUMMARY

Two cases of osteopetrosis are reported which belong to the mild group of this disease, in that in each instance the patient was able to get about and conduct himself normally, and in neither instance was the life of the patient threatened. On the other hand, in the first case we were confronted with greatly delayed healing of a seemingly simple fracture which disabled the patient a long time. In fact fifteen months after the occurrence of the fracture the patient was still wearing a leg brace and was not able to return to gainful employment. In the second case there was great deformity of the bones of the lower extremities and the spine resulting in severe dwarfing of the patient's stature. Thus one must bear in mind that osteopetrosis, although a relatively rare disease, may, when it does occur, be malignant and cause malnutrition, severe infections and even death early in life or, when less severe, may still be responsible for fractures, deformities and varying degrees of physica' disability.

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The Value of the Intramedullary Nail for Knee Fusion Particularly for the Charcot Joint

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Of the numerous methods proposed to produce knee arthrodesis probably the most recent to be described is that in which an intramedullary nail is used. Internal fixation by means of a three-flanged nail was described in 1946 by Bosworth.[1] In 1948 the use of the Küntscher type nail was advocated for this procedure, by Chapchal[2] who presented this method and described its technic. Since then few articles have appeared in the literature on the subject. Küntscher, in two papers,[3,4] mentions transarticular fixation with a very long nail. A series of twenty cases was reported by Stack[5] in 1951. We would like to present four additional cases and the complications encountered.

The advantages enumerated advocating this over other methods of knee fusion are similar to those advanced favoring fixation of femoral shaft fractures by intramedullary nailing. These are early solid fixation, early ambulation and weight bearing, and the reduction or elimination of the necessity of a cast. Less hospitalization, earlier rehabilitation and prompt return to gainful employment are important factors.

Chapchal reported six cases and seven operations. Three of these knees were involved with rheumatoid arthritis, two with traumatic arthritis and two were unstable joints secondary to poliomyelitis. His only complication was fracture of the nail at the joint line in one case. He recommended the use of stronger nails. He did not mention the time required for solid fusion. Stack reported twenty cases which he divided into three groups. The first was composed of six patients with tuberculosis of the knee. One complication, a fracture of the tibia at the distal end of the nail, was noted. Primary wound healing took place in all cases, and the average time of fusion was six months. His second group consisted of six cases of noninfectious arthritis. The average time of fusion was five and one-half months and the only complication was a transient peroneal palsy. Of the third group, consisting of eight Charcot knees, one obtained fusion and another was at a stage too early to evaluate. There were three complications. In one patient the pin wandered distally and the joint disrupted seven months after surgery, requiring amputation. In a second case the pin fractured at the joint level four months following operation. Another longer nail was used which also fractured. A third patient sustained a fracture of the femur across the window through which the pin was inserted.

In the technic described by Chapchal, an anterior approach to the knee joint is made through a 25–30 cm. incision extending from the tibial tubercle over the patella and up the thigh. The patella is excised, knee joint cartilage is removed and cancellous bone exposed. Then a window about 3 cm. long is made in the femur at the upper end of the incision. Through this window the intramedullary nail is driven into the femur and across the knee joint. Küntscher, on the other hand, does not make a window in the femur but uses an exceptionally long nail (65 cm.) and inserts it through the greater trochanter, across the knee joint and into the tibia to a level 10 cm. above the ankle. It is interesting to note that he also used this method to treat fractures close to the knee joint in older people, and obtained some motion following removal of the nail in all cases.

These four cases are presented primarily because of the complications which occurred in three of them. It had been hoped that because of the solid fixation and the impaction effect, this method would lend itself effectively

1 2A 2B 3

FIG. 1. Case 1. Fracture through upper third of window made in femur. FIG. 2. Case II. A, showing intramedullary nail in place; B, showing fracture through nail. FIG. 3. Fracture through window made in femoral shaft; note satisfactory knee fusion obtained by another method.

to the treatment of neuropathic joints. It was tried in three such cases and was unsuccessful upon each occasion. In one patient the use of the intramedullary nail was attempted but abandoned, but the complication was a result of the nailing.

CASE REPORTS

CASE I. M. G., a sixty-two year old white male, had been seen six years prior to surgery when the definite diagnosis of a Charcot knee joint was established. The knee instability and disability increased to such an extent that fusion was recommended. In July, 1950, an arthrodesis using an intramedullary nail was carried out. The patient was bearing full weight on the extremity two and one-half months after surgery, but used a cane. Three months following the operation the patient sat down and heard a snap in his thigh. X-rays disclosed a fracture of the femur through the window through which the intramedullary nail had been inserted. Fusion at the knee had not taken place. The fracture was treated by open reduction and plating. A cerebral vascular accident developed and the patient expired a week later. (Fig. 1.)

CASE II. M. P., a fifty-five year old Negro, had an established Charcot left knee. Fusion using an intramedullary nail was carried out in May, 1950. The patient was allowed to ambulate on the third week after surgery, with the knee protected by a light plaster cylinder. This was kept on for three months. X-rays at seven months showed fusion had not taken place. The patient was lost to follow-up for more than a year during which time he worked as a dishwasher. He had to stop work because of swelling, instability and some pain in the knee. X-rays showed the nail to have broken at the joint line. The nail was removed and another attempt at arthrodesis has been made. (Fig. 2.)

CASE III. N. W., a fifty year old Negro woman, had a definite diagnosis of Charcot knees, most severe on the left. In December, 1951, an arthrodesis was carried out. Difficulty was encountered in inserting the nail through the window in the femur and a tendency of the shaft to splinter about the window was noted. This method was abandoned, and fixation of

the knee with Steinman pins and turnbuckle compression was used. She was placed in a single hip spica. About two weeks postoperatively, while being turned in bed, the femoral shaft fractured through the window made for the intramedullary nail. The knee went on to a satisfactory solid fusion. However, the patient has refractured the femur and is still under treatment. (Fig. 3.)

CASE IV. P. C., a twenty year old Negro girl, was admitted with a stiff deformed knee in a position of 25 degrees varus and 15 degrees recurvatum. Three years prior to this she had been admitted to another hospital with a probable septic arthritis, possibly gonorrheal. On March, 1949, an arthrodesis using an intramedullary nail was carried out. She was kept in a hip spica three months. Six months following surgery the Küntscher nail was removed. The fusion is solid and in good position.

COMMENTS

The complications reported in this series as well as those by Stack should be noted. They are to some extent technical and can be guarded against. Nevertheless the defect created by windowing the femoral shaft is a point of weakness and therefore undesirable. The intramedullary nail, by fixing the knee, adds a long lever arm to act upon the weakened portion of the shaft. Fractures through this defect may be prevented by careful protection of the femur by a spica or at least by non-weightbearing until there is x-ray evidence of complete healing. But this, to an extent, offsets some of the virtues of the method. The long nail used by Küntscher and inserted via the greater trochanter eliminates the necessity of a window in the femur and perhaps in this respect is a more desirable method.

The chance of fracture of the nail at the joint line can be lessened, according to Chapchal, by using heavier nails. However, if fusion does not take place or is greatly delayed, as so frequently occurs in neuropathic joint disease, the constant motion taking place over a long period of time would probably break any size nail available. Fortunately only minimal difficulty was encountered in removing the nail in Case II.

SUMMARY

1. Four cases of knee arthrodesis using an intramedullary nail are presented. Three of these were cases of Charcot joint, and complications occurred in each of these.

2. The complications consisted of fracture of the femur through the window used for insertion of the intramedullary nail in two cases and fracture of the nail at the knee in one case.

3. In attempting an arthrodesis in the Charcot knee, the use of the intramedullary nail is of doubtful value.

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Somatic Pain and Autonomic Concomitants

REFLEX SYMPATHETIC DYSTROPHY

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REFLEX sympathetic dystrophy is a term introduced in recent years to designate a group of trophic disorders resulting from autonomic nerve dysfunction. It is implied that the sympathetic division plays the chief role in the development of the clinical picture and that afferent stimuli represent the precipitating influence for the onset of the disease.

Current viewpoints on the nature of the condition are expressed in an extensive review of the subject by Steinbrocher, Spitzer and Friedman,[1] emphasizing the shoulder-hand syndrome. Regarding the mechanism of development they state, "It must take into account these pertinent clinical facts: (1) conditions of widely separated location, such as myocardial infarction, herpes zoster, peripheral injuries, etc., can cause practically the same clinical picture; (2) this disorder seems to involve not only the autonomic system, parasympathetic as well as sympathetic, but also the motor pathways to muscles; (3) the disturbance does not show a definitely segmental pattern of distribution; and (4) it is often improved or abolished by interruption of the sympathetic nerve supply to the upper extremity."

From an analysis of medical opinions it appears that the foremost difficulty in the interpretation and management of these disorders is the identification of an anatomic factor which is sufficiently constant to establish a relationship to the disease. In an attempt to clarify this problem the following observations suggest a solution.

Investigations in cases of musculoskeletal disorders have revealed structural abnormalities at two sites in the lower part of the back, i.e., the mid-sacral paraspinal region and the mid-lumbar region over the lateral portion of the sacrospinalis muscle. The changes consist of fibrosis of subfascial fat, with adhesions between this and the overlying lumbodorsal fascia.[2,3]

The initial injury is evidently a rupture of the lumbodorsal fascia produced by contraction of muscles attached to the fascia at these sites, the gluteus maximus in the sacral region and the latissimus dorsi at the lumbar level. With subsequent repair of the torn structures, fibrous connections develop between them. This type of pathologic alteration was found in 87 per cent of sites explored surgically; it represents the primary source of noxious impulses, or trigger point.

From a painful site of this nature, impulses arise and are referred to other portions of the body in accordance with a spinal segmental (sclerotomic) pattern of distribution. Referred phenomena of this type include pain and tenderness; they constitute the clinical manifestations in many painful disorders which are interpreted as arthritis, fibrositis, bursitis, nonarticular rheumatism and similar varieties of disease.

In addition to somatic nerve effects, autonomic nerve reactions may develop as a result of the painful impulses at the sites of injury; they may appear in many forms and in any part of the body without restriction to sclerotomic limits. According to Kuntz,[4] "Afferent impulses arising in any part of the body may elicit reflex reactions carried out by autonomic nerves." The pathophysiologic effects developing from autonomic nerve activity may be vasomotor, trophic, visceral or, probably, metabolic in nature.

Within the scope of somatic nerve influence, three clinical syndromes of pain are recognizable as effects derived from the anatomic lesions:

1. The mid-sacral (first sacral nerve) syndrome develops from the sacral lesion; referred pain is most conspicuous in the buttock and, less frequently, in the thigh, leg and foot; referred tenderness is elicited mostly in the lower part of the buttock. The trigger point is found at the level of the third sacral vertebra near the spine.

2. The mid-lumbar (second lumbar nerve) syndrome is characterized by referred pain and tenderness in the lower lumbar, upper sacral and sacroiliac regions. The trigger point is found over the lateral third of the sacrospinalis muscle at the level of the upper margin of the iliac crest.

3. The latissimus dorsi (sixth, seventh and eighth cervical nerves) syndrome may develop from irritation of the aponeurosis of this muscle at either of the sites of injury, sacral or lumbar. Under these circumstances, referred pain and referred tenderness develop in the sclerotomic distribution of the sixth, seventh and eighth cervical nerves.

The relationship of the pathologic changes at the two sites of injury to the somatic nerve effects (referred phenomena) has been satisfactorily established by operative findings and results; added support was obtained by observations following diagnostic injection of local anesthetic into the trigger points.

The surgical procedure employed for correction of the disability consists of exposure under local anesthesia of the lumbodorsal fascia at the sites of injury, indicated by tenderness; incision of the fascia; dissection of adhesions from the ventral surface of the fascia; resection of the fibrosed subfascial tissues; and insertion into the operative field of a drain which is left in place for five to seven days. The surgical principle involved in this procedure is denervation of the subfascial structures from which the noxious impulses arise.

CASE REPORTS

CASE 1. This fifty-eight year old man was examined in August, 1952. In January, 1952, while at work as a pin setter in a bowling alley, his right leg had been struck by a bowling ball, causing a fracture of the tibia. He was treated elsewhere for this by immobilization in a plaster cast and obtained a satisfactory union, in good position and alignment. He complained of pain in the right knee and in the upper and lower parts of the right leg; the pain was constant in some degree and aggravated by walking, sometimes causing a limp. He also complained of weakness of the right knee and a painful "cracking" when walking or in bending the knee.

Examination showed slight enlargement of the tibia at the junction of the upper and middle thirds. Mild tenderness was elicited at several points in the leg. Motion in the knee was normal in range, accompanied by moderate crepitation which he described as being painful. He was unable to support his weight in getting down to a squatting position or in getting up from this position due to pain and weakness of the knee. No other abnormalities were found in the lower extremities.

Examination of the back revealed, after a lengthy search, a small area of tenderness in the right lumbar region over the lateral border of the sacrospinalis muscle and at the level of the upper margin of the iliac crest. This was elicited on moderately heavy pressure and was identified only by comparison with the same maneuver on the opposite side. There was no history of pain in the back at any time.

Although the degree of tenderness in the right lumbar region was so mild as to appear insignificant, the sulfascial space at the site was infiltrated with procaine. About ten minutes later he stated that the pain in the leg and the knee had subsided. He was at this time able to support his weight in bending down and rising from this position.

On the following day he stated that he had been completely free from the pain in the leg and the knee, that the crepitation and weakness of the knee had disappeared and that he had practically normal endurance in walking. He has not been examined since. Indirect information about two months later indicated that he had retained the relief from his symptoms.

Comment. The most important feature in the interpretation of the clinical picture is knowledge of the pathologic condition in the lumbar area. The degree of tenderness elicited at that point appeared sufficiently trivial to be insignificant, yet the site could be identified as the primary source of afferent impulses related to the disability. The reason for ascribing the clinical manifestations to autonomic nerve reactions lies in the fact that the pathologic lesion is situated in the sclerotomic field of the second lumbar nerve, which does not provide somatic afferent supply to structures at or below the knee joint.

The promptness of the response noted in this case is not unusual, although more commonly a longer period of time is required for such change.

It is noteworthy, also, that this patient had a claim for his injury in the industrial court, that

he was a surly, irresponsible individual who would be expected to take advantage of his disability for financial gain, and that all the important features of his handicap were subjective in nature.

Case II. A fifty-four year old woman was examined in March, 1953. Two months previously she had slipped and fallen on an icy walk, sustaining mild injury to the left leg and ankle. This was not serious enough to require medical attention. She experienced mild pain in the lower half of the left leg. Within one week after the accident the lower half of the leg became swollen and somewhat more painful, and the skin of that part of the leg assumed a bright red color. There was no swelling, pain or color change at or below the ankle. She had consulted a physician ten days previously; an elastic bandage had been applied to the swollen part.

Examination showed the skin in the lower half of the left leg to have a bright red color and a glistening appearance. Pitting edema was present in that part and several points of moderate tenderness were found. There was no abnormality of the ankle or foot. The circumference of the left leg 2 inches above the ankle joint was ½ inch more than that of the right leg. In the upper part of the left leg beyond the level of the swelling the circumference of the left leg was ¼ inch less than that of the right.

Examination of the back revealed several points of mild tenderness in the left sacroiliac region, and also in the left lumbar region over the lateral portion of the sacrospinalis muscle at the level of the upper margin of the iliac crest. There was no history of injury or disability of the back at any time.

Roentgenogram of the left leg and ankle showed no abnormality.

Several days later the tender site in the left lumbar region was injected with procaine. One and a half hours later the skin was normal in color and the leg was much less sensitive to rubbing, pressure and manipulation. The site in the left lumbar region was reinjected for the purpose of prolonging the anesthetic effects.

She reported later that for about five hours after the second anesthetization she experienced virtually complete relief from all manifestations, including pain, swelling, tenderness and color changes. All these features recurred gradually after several days although they were less intense. A gradual diminution of all clinical manifestations took place, so that three months after the injection she was completely relieved except for occasional mild aching in the leg.

Comment. In this case objective evidence of autonomic nerve reaction was more obvious. Again, the problem of determining relationships was facilitated by knowledge of the existence and the influence of the pathologic lesion in the lumbar region. Here, also, the clinical features were present in a location which is not supplied by somatic afferents from the same spinal nerve as that in which the original noxious impulses arise.

Case III. This woman, aged forty-nine, was examined in February, 1953. Four months previously her right ring finger had been extensively crushed and lacerated when a wheel of an automobile passed over it. She was treated elsewhere for this over a period of ten weeks. The result was a finger which was stiff, painful, swollen and discolored. She described pain radiating from the finger to the elbow and the shoulder.

In examination the right ring finger was smaller than normal. The skin in the lower two phalanges was bluish in color, with a tense, glistening appearance. Only a few degrees of motion were present in the two interphalangeal joints. Moderate to marked tenderness was elicited in all portions of the lower two phalanges. Less pronounced tenderness was found at the wrist, elbow, shoulder, the pectoral region and the latissimus dorsi muscle. In the lower part of the back scattered points of tenderness were found in the gluteal region, the lower lumbar, upper sacral and sacroiliac areas. Both the sacral and lumbar sites, vulnerable to injury, were distinctly tender. The patient insisted that she had never had any disorder of the back.

Two months later the condition was unchanged. The sacral and lumbar trigger points were injected with procaine intrafascially and subfascially, eliminating the tenderness at these sites. Two hours later the pain and tenderness in the right hand were markedly relieved and active motion was more free and less painful. After another period of two hours there was a distinct diminution of the tense swelling of the finger, so that wrinkling of the skin was noticeable. Active motion of the fingers was easier to perform although there

was no change in the range of motion in the interphalangeal joints. There was also, at this stage, a marked diminution of tenderness previously noted in other parts of the upper extremity, the pectoral region and the latissimus dorsi muscle.

Comment. The relationship between the source of impulses in the lumbar region and the pain in the right ring finger is partially sclerotomic, by the process of referred pain and referred tenderness, which evidently arose in the pain receptors of the aponeurosis of the latissimus dorsi muscle. This mechanism of reference may account for the somatic component of pain in the injured ring finger and also in other parts of the upper extremity and the pectoral region, all of which are supplied by the sixth, seventh and eighth cervical nerves. The principal evidence of participation of the autonomic nervous system was the tense swelling of the finger, which was substantially diminished by abolishing the afferent impulses at their source. In the analysis of the total picture it is evidently necessary to consider noxious stimuli from two sources: (1) those which arise in the deranged tissues of the finger and (2) those derived from the painful lesion in the lumbar area. In this instance the process of summation of afferent impulses from these two sources was considered to be operative in aggravating the clinical manifestations.

In this case, likewise, knowledge of the powerful influence of afferent impulses arising in the deranged structures in the lumbar region provided the explanation for intensification of the clinical features.

CASE IV. This fifty-one year old man was examined in December, 1952. In March, 1951, while working as a railroad switchman, he had fallen from a railway car. In this, he sustained lacerations of the skin of the left leg, a fracture of the lower end of the left fibula and an injury to the lower part of the back. He was treated elsewhere and spent one month in a hospital.

Immediately after the accident he experienced frequent headache and attacks of dizziness; he noted difficulty in evacuation of the bowels and bladder. These features subsided gradually during the first year after injury. The manifestations which persisted were pain in the lower part of the back and in the left foot, numb feeling of the left leg and loss of motion in the toes of the left foot. Pain in the foot caused a limp due to the necessity of assuming a position of outward rotation of the lower extremity in walking.

Examination showed the limp in walking with the left foot rotated outward about 45 degrees. The skin of the toes and metatarsal regions in the left foot was markedly hypoesthetic on the dorsal and plantar aspects. The plantar surface of the left foot was tender. Motion of the toes was limited, apparently due to weakness of the muscles. The left leg showed ½ inch loss in circumference. Scars in the skin on the anterior aspect of the left leg were healed, movable and non-tender.

Examination of the back revealed numerous sites of tenderness in the lower lumbar, upper sacral and sacroiliac regions of both sides; it was possible also to elicit definite tenderness bilaterally in the mid-lumbar region over the lateral portion of the sacrospinalis muscle.

Roentgenographic examination had not been undertaken until approximately one year after the accident. The films showed an old compression fracture of the fourth lumbar vertebra. It was impossible to determine any relationship of this condition to the accident.

At a later date the site of tenderness in the left mid-lumbar region was injected with procaine, eliminating all tenderness in that location.

Three hours later sensation had returned at the injected site and it was reinjected. About fifteen minutes later the man stated that sensation in the toes of his left foot was noticeably improved. No significant change was noted otherwise.

Two hours after the second injection he reported that for a period of about one hour he was relieved of the pain in his left foot, enabling him to walk without limp and with the foot in a normal position. The pain in the lower part of the back was described as being less intense and located in a smaller area than ordinarily. Examination showed marked diminution of the tenderness in the lower part of the back, improved sensation in the skin of the left foot and improved motion of the toes in flexion and extension.

Comment. All the important features of the disability were greatly modified by temporary interruption of afferent impulses arising from the suspected trigger point. Considerable difficulty was encountered in the investigation due to a number of factors which required consideration as influences in the development of the

clinical picture. Complete evaluation was not possible due to failure of the patient to return for additional study. There was reason for suspicion that a similar lesion was present in the right lumbar region, to account for some of the clinical findings. The observations indicated clearly the role of afferent impulses from the left lumbar region as the most significant factor in producing the disability in the left foot. Here, as in Cases I and II, the autonomic nervous system is the only influence which could be considered in the developments in the left foot.

CASE V. This sixty year old man was examined in August, 1950. In January, 1949, while engaged in work requiring heavy lifting, he had experienced a sudden attack of pain and weakness of the right shoulder. At the same time he noted numbness and weakness of the right hand which later became swollen. He was treated in a hospital for three weeks. After dismissal he experienced pain in the lower part of the back on the right side, with radiation to the groin. He was unable to perform any type of work. The condition had been practically unchanged since onset.

Examination showed no significant atrophy of muscles in the right shoulder, scapular region or the upper extremity. Active abduction and flexion of the right arm were possible to 90 degrees and somewhat painful. Inward and outward rotation were approximately normal. Moderate tenderness was elicited at numerous points in the scapular region, the right shoulder and arm. From several sites in the scapular region pain was described as radiating to the shoulder.

In the right side of the back below the costal margin and over the lateral portion of the sacrospinalis muscle was an old adherent and retracted scar 2 inches long and 1 inch wide. This had been caused about fifty years before and had never troubled the patient. Immediately below this, at the level of the third lumbar vertebra and over the lateral portion of the sacrospinalis muscle, distinct tenderness was elicited. Tenderness was also found along the right iliac crest and in the right groin.

The right hand was swollen without pitting of the tissues on pressure. There was no wrinkling of the skin. The dorsum of the hand showed a dusky red erythema. The skin was anesthetic to pin prick below the wrist; between the wrist and the elbow it was hypoesthetic. The fingers could be actively although incompletely extended, but flexion was weak so that he could not approximate the ends of the fingers to the palm of the hand.

Roentgenograms of the right shoulder showed a moderate degree of hypertrophic arthritis but otherwise no abnormality.

The condition was interpreted as shoulder-hand syndrome. It was considered likely that the site of tenderness in the right mid-lumbar region provided the afferent impulses for stimulation of the autonomic nervous system. A painful pathologic lesion at this site was regarded as the cause of the pain in the groin, representing the second lumbar nerve syndrome. In the upper part of the body development of the latissimus dorsi syndrome could account for the somatic nerve manifestations, as pain and tenderness. The vasomotor and sensory disorders of the upper extremity and the muscle weakness were regarded as autonomic nerve reactions.

The man was seen at intervals thereafter; his condition was unchanged. In May, 1951, all the important features of the disability seen at the first examination were present. Dynamometer reading of the left hand was 20 pounds, that of the right 0 pounds.

The painful site in the right mid-lumbar region was injected with procaine to anesthetize the subfascial structures and the aponeurosis of the latissimus dorsi muscle. Two hours later the patient stated that the pain in the arm and shoulder was noticeably relieved. Sensation in the skin of the hand was improved. Dynamometer reading in the left hand was 80 pounds and that in the right was 20 pounds. The mid-lumbar site was reinjected with procaine.

One hour after the second injection additional improvement was noted subjectively and objectively. The patient stated that the pain in the upper parts of the body had disappeared completely; he had less pain in the lower part of the back. Sensation in the skin of the right hand was markedly improved. The edema was less pronounced, with a noticeable return of wrinkling in the skin, and the color of the hand and forearm was more normal. Dynamometer reading at this time was 80 and 85 pounds in the left hand and 40 and 50 pounds in the right hand. Abduction and flexion of the arm at the shoulder were increased 30 degrees.

According to later reports, this state of im-

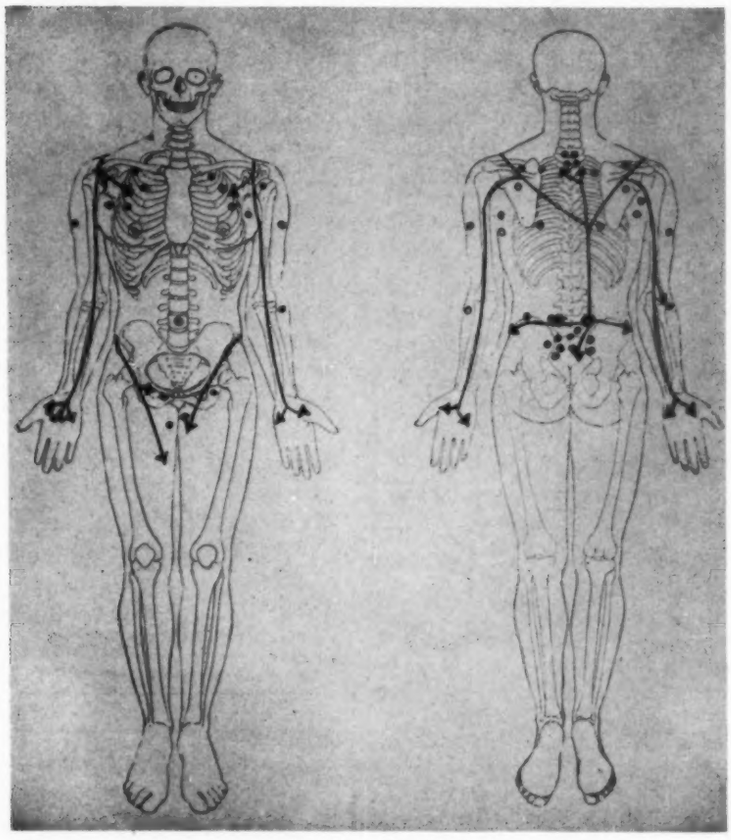

FIG. 1. Anatomic chart showing distribution of referred pain and referred tenderness derived from pathologic lesion in right mid-lumbar region (indicated by solid marking). Darted lines show distribution of referred pain; small circles show location of most common sites of referred tenderness. Markings distal to site of trigger point indicate extent and distribution of second lumbar sclerotome; markings proximal to that point show extent and distribution of somatic manifestations observed with latissimus dorsi syndrome (sixth, seventh and eighth cervical nerves). Note contralateral reference of pain and tenderness.

provement persisted for about two days, followed by gradual return to the previous state of disability.

Comment. This patient presented the characteristic features of the shoulder-hand syndrome. The chief observations of interest are the location of the suspected trigger point in the lumbar region and the influence of this in giving rise to the disabling features. Among the latter are pain, trophic and vasomotor changes and muscle weakness; all of these were temporarily reversed by interruption of the afferent impulses from the trigger point.

REMARKS

In the analysis of the clinical course of this group of patients the outstanding observation is the uniformity of the anatomic lesion which is considered to be the primary source of the noxious stimuli. Although the structural alterations which are regarded as the principal factor for the onset and progression of the disease have not been visually verified, it may be assumed with reasonable certainty that they are similar to those previously demonstrated in other types of disorder. This attitude appears justifiable in view of the observations made by physiologic methods of investigation, such as temporary interruption of afferent impulses from the suspected site by local anesthetization. It is noteworthy that the response to the diagnostic procedure was sufficiently obvious and sufficiently prompt to provide support for this viewpoint.

It should be emphasized that the clinical manifestations reveal nothing to suggest an investigation of the lesion which is regarded as the trigger point for the genesis of the disease. The only motive for the search was knowledge of the existence of such lesions and provided that the common trigger point is recognized.

The direction and the distribution of sclerotomic pain and tenderness, seen with a combination of the second lumbar nerve and the latissimus dorsi syndromes, are illustrated

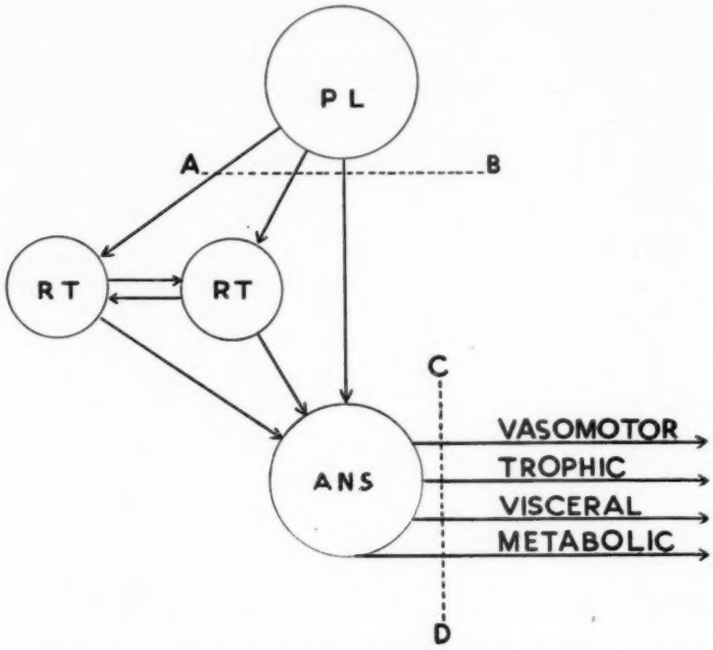

FIG. 2. Diagram showing series of manifestations in genesis of autonomic nerve dysfunction. The pathologic lesion (PL) gives rise to painful impulses resulting in referred tenderness (RT) and dysfunction of autonomic nervous system (ANS). The line C-D shows the location where interruption of noxious impulses is carried out according to current procedure most commonly employed. The line A-B shows the site where impulses were interrupted in this series of cases.

the powerful influence which they may exert in upsetting normal physiologic activities.

It is significant that these were the only patients so afflicted who were investigated by this method.

The principal clinical feature is pain. This may be of two types, i.e., somatic nerve pain and that caused by autonomic nerve dysfunction. These two kinds of pain may coexist and raise difficulties in differentiation. This is all the more likely in cases in which the somatic nerve effects (referred or sclerotomic phenomena) appear in the same parts of the body as the autonomic nerve reactions. Inasmuch as both somatic and autonomic nerve effects were obviously derived from the same source of sensory stimuli, the precise distinction of effects initiated by each neuronic system is, for practical clinical purposes, of minor importance in Figure 1. The mechanism of development of autonomic nerve dysfunction is illustrated in Figure 2. This process appears to occur as a chain of events in contrast to the customary interpretation of the course as a "vicious circle."

It is probable that the physiologic principle of summation of impulses is operative in the genesis of many clinical conditions of this nature. This is evident from the observation that frequently a very mild trauma gives rise to profound disturbances which are greatly out of proportion to the gravity of the injury. Observations in this group of patients demonstrate clearly that one component of harmful influences was derived from the site in the lumbar region and that, with the elimination of this feature, the existing disability was greatly reduced or completely abolished.

It is realized that several of the cases in this series do not present objective evidence of extensive tissue damage that is ordinarily seen in the more serious forms of disease classified as reflex sympathetic dystrophy. However, the subjective manifestations, the clinical course and the anatomic and physiologic relationships are, in all important respects, similar to those seen in the more obvious and more violent forms of disability. Since the clinical features appear outside the distribution of the somatic nerve supply, it seems necessary to ascribe the effects to participation of the autonomic nervous system.

Weakness or complete paralysis of muscles may be due in part to somatic nerve effects, but only to the extent that active motion is inhibited by pain; a more likely explanation is the development of trophic disorders resulting from autonomic nerve dysfunction.

SUMMARY

From observations in five cases there is reason to believe that the clinical picture of reflex sympathetic dystrophy is in large part dependent on afferent impulses derived from a pathologic lesion of soft tissue structures in the lower part of the back. The lesion is characterized by fibrosis of subfascial fat, with fibrous connections between this structure and the overlying lumbodorsal fascia. Sensory stimuli initiated at this site give rise to the somatic effects of referred pain and referred tenderness. In addition, they may activate the autonomic nervous system. The reactions of the autonomic system are represented by changes which may be vasomotor, trophic, visceral or metabolic in nature.

When this mechanism is suspected from the physical findings, it is relatively simple to verify it by anesthetization of the pathologic lesion. This procedure sometimes provides satisfactory relief for indefinite periods of time. Surgical correction consisting, in principle, of denervation of the abnormal structures is more likely to restore adequate function.

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Local Anesthesia in Facial and Jaw Fractures

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IN the surgical treatment of facial or jaw injuries the anesthesia of choice is of great importance. This paper illustrates the use of 2-isobutyl amino ethyl meta amino benzoate (unacaine®) in sixty-three facial and mandibular fractures and other frequently encountered facial injuries, with special reference to cerebral injury as a complicating factor.

HEAD INJURIES WITH POSSIBLE CEREBRAL DAMAGE

It should be pointed out that head injury with possible brain damage is looked upon as a contraindication[1] to the immediate reduction and fixation of mandibular and facial fractures if the patient is to be treated under general anesthesia. This is generally true; however, when surgery can be performed under infiltration or nerve block anesthesia in borderline cases of conscious patients with questionable cerebral damage without endangering the safety of the patient, the result of the operation will be superior than if surgery were delayed until the period of observation for cerebral damage was over. Usually a fractured, retrodisplaced mandible causes respiratory embarrassment due to relaxation of the structures of the floor of the mouth.

We have followed the principle of early reduction and adequate immobilization in the reported cases and believe that early treatment has aided in the obtaining of a superior functional and cosmetic result as well as aiding the patient's recovery.

Occasionally we are called on to reduce facial fractures after other fractures of the body have been reduced and immobilized. We believe that moving the patient to the operating room, especially if traction apparatus has been set up for the other fractures, is unnecessary and often harmful. In these cases one can also utilize regional or infiltration anesthesia and perform the procedures at the bedside.

The most important first step in the examination and treatment of jaw and facial fractures is the obtaining of adequate x-ray films. In many cases stereoscopic films are preferable in order to ascertain the exact relationship of the fragments. One of the first things ordinarily done while waiting for development of the films is the administration of tetanus antitoxin or an active immunization with tetanus toxoid. Graham and Scott[2] have shown that active immunization with toxoid reduces the incidence of tetanus if the patient has already been actively immunized. We then use a "booster" dose of 1 cc. If the patient has not been actively immunized, 1,500 American units of antitoxin should be given and repeated at weekly intervals until three doses have been administered.

ANESTHESIA

Premedication. All adult patients in this series received premedication of demerol, 100 mg., and atropine or scopolamine, 1/150 gr. Barbiturates are not routinely given because of their depressing action on the central nervous system; however, sodium amytal and oxygen a.e routinely available for immediate use should any signs of toxicity be apparent. In no case in this series did these signs of intoxication develop.

Tecbnic. Infraorbital injection is accomplished by an injection of 2 to 3 cc. of unacaine into the infraorbital foramen which is situated about 1 cm. below the lower orbital margin, about mid-way between the inner and outer angles. (Fig. 1.) This anesthetizes the lower eyelid, skin and cartilage on the side of the nose and the upper lip.

The second division of the trigeminal nerve may be anesthetized by passing the needle through the buccinator muscle into the infratemporal fossa and then into the pterygopalatine fossa where the solution is deposited. The landmarks of this injection site are the anterior

border of the ramus and the coronoid process of the mandible. Then the base of the zygomatic process of the malar bone is palpated and at this place the needle is directed horizontally at right angles to the cheek, slightly backward clearing the tuberosity and then upward where bone will again be encountered. This will be in the pterygopalatine fossa which is under the greater wing of the sphenoid just below the foramen rotundum. (Fig. 2.) Two or 3 cc. of solution will be sufficient anesthesia for the surgery of the maxillary bone, the maxillary sinus, alveolar process, operations of the soft tissue of lips, nose and cheek, almost covering the entire side of the face.

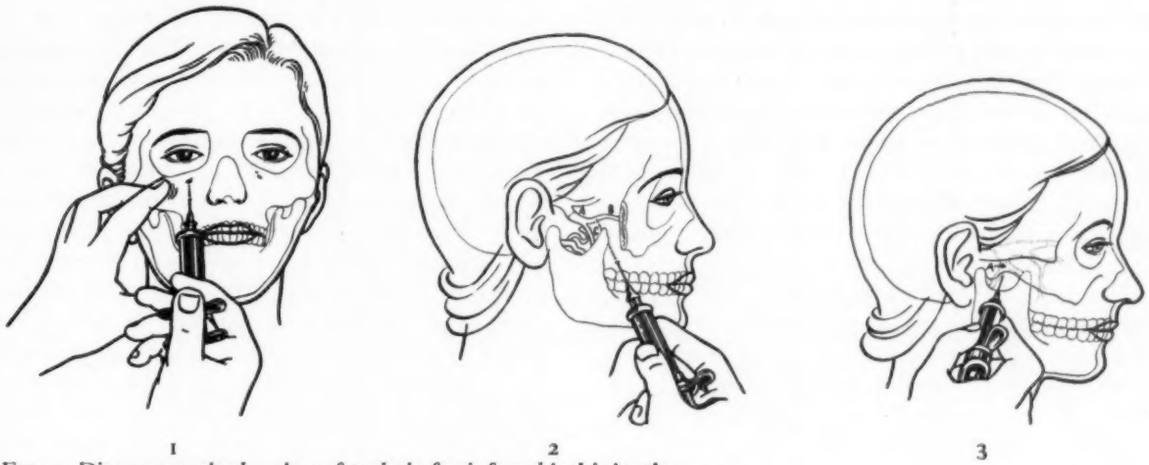

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FIG. 1. Diagrammatic drawing of technic for infraorbital injection.

FIG. 2. Diagrammatic drawing of technic for injection of second division of the trigeminal nerve. A, foramen rotundum; B, maxillary division of trigeminal nerve; C, postero-superior dental nerve.

FIG. 3. Diagrammatic drawing of technic for injection of mandibular nerve. A, mandibular nerve exit from foramen ovale.

There are many approaches for the injection of the mandibular division of the fifth nerve. We use the technic for anesthetizing the nerve at its exit from the foramen ovale. One landmark for this procedure is the sigmoid notch, which may be located as a distinct depression just anteriorly to the condyle of the mandible and below the zygoma. The condyle can be easily detected by opening and closing the patient's mouth. The other landmark is the inferior border of the zygomatic arch. Into this depression just described the needle is inserted at a right angle to the surface of the cheek and is advanced about 30 mm. The needle will generally strike bone and this will correspond to the smooth undersurface of the greater wing of the sphenoid just external to the foramen ovale. (Fig. 3.) About 2 to 3 cc. of unacaine are injected after aspirating to see if the needle is in a vessel. This anesthetizes the lower jaw, gum tissue, floor of the mouth, a portion of the cheek and the anterior two-thirds of the tongue.[3–6]

TECHNIC OF REDUCTION

Anatomic Considerations. In facial and jaw fractures the correct dental occlusion is very important because when the occlusion is reestablished the bone fragments are in good functional alignment. The pull of the muscles attached to the mandible is the chief reason for displacement of the fragments. The masseter, temporal, internal and external pterygoid muscles generally tend to pull upward and inward. The mylohyoid, digastric and geniohyoid muscles tend to pull downward and inward. The displacement of the fragments is also caused by the direction and bevel of the fracture line, and by the direction and intensity of the traumatic force.

Mandible and Maxillary Fractures. Of the twenty-eight fractures of the mandible nineteen were reduced with intermaxillary splints, four were reduced by open reduction and interosseous wiring, three by circumferential wiring and two by external fixation. All patients received the aforementioned premedication and unacaine anesthesia utilizing the mandibular division of the fifth nerve approach previously described. All mandibular fractures were re-

duced and fixed without discomfort to the patient.

For the five fractures of the mandible and maxilla the foregoing procedure was followed plus infraorbital injection and second division block of the trigeminal nerve.

The displacement in maxillary fractures is not as great as in mandibular fractures. The fractured parts are usually moved downward, laterally and backward. Some maxillary fractures are impacted. Although displacement of the facial bones is not great, slight displacement affects the facial contour and is noticeable following injury. Fractures in the maxilla may alter the orbital cavity and cause visual disturbances.

The general care of maxillary fractures is similar to that used in mandibular fractures. When both the mandible and maxilla are fractured, the entire facial structure may be so distorted that reduction in stages is necessary. In multiple fractures we delay complete reduction of the fragments in some cases in order to gain support by taking advantage of partial healing and fixation in one area or another. We have found local anesthesia useful, and a satisfactory reduction is eventually obtained by manipulating different fragments as healing progresses. Each type of fracture requires a special type of immobilization which is found adequately discussed in detail by leading authorities.

Fractures of the Nose. In this series five fractures of the nose were reduced under unacaine anesthesia by injection of a total of 8 cc. locally along the dorsum and in each nasolabial fold. In addition, most cases required topical anesthesia which was accomplished by packing the nostril with pontocaine. The fragments were then manipulated manually with straight hemostats introduced in the nostrils to elevate the depressed fragments. An aluminum or metal splint was used for immobilization. This was fashioned from an ether can which is commonly available in any hospital, and is cut to pattern with bandage scissors. This splint is held in place with adhesive tape and is molded daily to keep the bridge of the nose narrow for five to seven days.

Fractures of the Zygoma. Fractures of the zygoma in this series were reduced using the oral approach, a stout elevator being passed upward behind the zygoma to elevate the fragment. We believe that this is a simpler approach than the Gillies method. Injection of the infraorbital nerves plus deep infiltration in the incision lines give good anesthesia.

Soft Tissue Wounds. We believe that soft tissues should *not* be sutured before bony fragments are immobilized for several reasons. It is always possible to tear apart a recently sutured facial wound in the process of stretching the skin in order to gain exposure. This is especially true in lacerations around the mouth. Secondly, an open wound may give excellent access to fracture sites if open reduction is necessary. Thirdly, better alignment of tissues is always accomplished if the bony framework is returned to its original position before the two edges of a skin laceration are lined up in closure. We therefore consider only the control of hemorrhage and cleansing of the wound before immobilization of the fracture and then deal with the closure of the soft tissues themselves after fixation of the fragments. In lacerations of the lip a better cosmetic result is obtained with nerve block rather than local infiltration in the lacerated area because local infiltration tends to balloon the tissues out of normal proportions.

Postoperative Care. Common pathogens in contaminated wounds can usually be controlled with 1 gm. of streptomycin and 300,000 units of penicillin twice a day.[7] We believe that oral hygiene is very important in all cases involving the oral cavity, and recommend phylorinol as a mouth wash.

SUMMARY

Reported is the treatment of maxillofacial injuries using a new local anesthetic which is positive in its action, rapid in its induction and profound in its intensity.* We believe early immobilization is of great importance and may be accomplished safely without the risk of a general anesthetic in patients who have or are suspected to have head injury. This early reduction is also important, even in cases of possible cerebral damage, in order to obtain the best cosmetic and functional results. Local anesthesia enables early reduction in cases of questionable cerebral damage which might be impossible if general anesthesia were the only agent available. It should also be pointed out

*The anesthetic solution used is available under the trade name unacaine and was generously supplied for this study by the Novocol Chemical Manufacturing Co., Inc., Brooklyn, N. Y.

that oral hygiene is very important in the treatment of facial fractures.

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In patients with clinical hyperparathyroidism often a palpable nodule in the neck is absent and x-rays may fail to show a calcified parathyroid. Since these patients have severe symptoms whether the increased function was due to hyperplasia, adenoma or carcinoma, exploratory operation is indicated. If the hyperfunctioning parathyroid cannot be found and one of the four is absent from its normal anatomic location, subtotal thyroidectomy is advisable on that side since the abnormal gland may be imbedded in the thyroid. If not, the diseased parathyroid may be located in the mediastinum and is usually found and removed subsequently via sternotomy. It is occasionally found at the site of the thymus gland and any remnant of the thymus should be removed at this same time. (*Richard A. Leonardo, M.D.*)

Causes of Operative Mortality in Chronically Ill Geriatric Patients

II. WITH AN ANALYSIS OF EIGHTY ADDITIONAL CONSECUTIVE AUTOPSY RECORDS

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A PREVIOUS communication in 1948[1a] discussed the causes and possible reduction of operative mortality in substandard risk patients sixty years and over, most of whom were already hospitalized for degenerative diseases and who died within one month after operation. The facts were based on an analysis of 100 consecutive autopsy records between the years 1939 and 1946. The principal and contributory causes of death during this period are listed in Table I. The present study includes a comparative analysis of the next eighty consecutive autopsy records during the period 1946 to 1952 (Tables I and II) when antibiotics became generally available to the profession and when there was improvement in anesthesia, anticoagulant therapy and blood transfusion, and a better understanding of chemical balance, blood dyscrasias, blood volume deficit, preoperative digitalization and shock. Cumulative experience taught better and more accurate diagnosis, better indications, contraindications and types of surgical therapy. This study shows that the pattern of operative causes of death is similar to that in the previous study except that there is now a diminution of the principal causes of death from cardiac failure, sepsis, and peritoneal and kidney infection. At the same time, our statistics during the second period show an over-all decline in operative mortality of about 7 per cent in elective and 21 per cent in emergency surgery. (Table III.)

Statistics are difficult to interpret and evaluate. Even cases which fall in the same groups are not comparable because senescence, the aging process, and complex, varied and multiple pathologic states vary in different individuals. However, autopsy findings are factual and their analysis produces an over-all picture which approximates the truth and makes generalizations possible.

CAUSES OF OPERATIVE MORTALITY

These may become difficult to evaluate in chronically ill geriatric patients because of concomitant disease of the heart, blood vessels, kidneys, lungs, liver or brain, with possible accompanying metabolic disturbance. All these contribute to deterioration and mortality. The principal and contributing causes of death may be so interrelated, multiple and confusing that it is sometimes hard to establish the primary cause of death, even with autopsy. In this report only those who died within one month after operation are included because they might have died during this period without operation, especially in emergency conditions, and because during this period the patient feels the maximum effect of an operative procedure. It is at this time that the surgeon uses his greatest effort to tide him over. Diminished homeostasis in the aged makes more exact diagnosis imperative so that indications may be met with directness, and error and fumbling reduced to a minimum. Younger people have more reserve and can recover more easily.

Emergency Surgery. Table III shows how much higher the mortality is in emergency as compared with elective surgery. It is approximately twice that of the latter. This figure becomes understandable in view of the greatly increased risk in acute cases because generally these patients come to operation too late, especially when there are spreading infections and obstruction in the circulatory or other systems. Deterioration is then very rapid. Valuable time may pass because differential

diagnosis may be difficult and work-ups too prolonged; the pain threshold is usually lowered; a pathologic mental state may interfere with an accurate recital of history and symptoms; preoperative preparation may be too prolonged; defeatists have a natural tendency to postpone surgery because the patients "are too sick or too old"; there is often hope for the subsidence of a pathologic state as balanced against the feared surgical risk. It is heartening to know that surgery saved many lives which would have been doomed without it.

Statistical Analysis of Causes of Mortality. In the present study sixty-six men and fourteen women were autopsied. The oldest patient was ninety-four years of age. The average age was seventy-two for both sexes. Table IV indicates the sexes and decades into which the patients fell. Mortalities tend to increase with each advancing decade.[15]

TABLE I

ANALYSIS OF CAUSES OF DEATH IN 180 CONSECUTIVE AUTOPSY RECORDS IN PATIENTS SIXTY YEARS AND OVER*

	1939–1946		1946–1952	
	Principal Causes	Important Contributing Causes	Principal Causes	Important Contributing Causes
Bronchopneumonia	28	10	31 (38.8%)	2
Cardiac failure	27	3	8 (10%)	..
Pulmonary edema	...	..	6 (7.5%)	1
Peritonitis	18	1	12 (15%)	..
Thrombosis and embolism	7	2	8 (10%)	1
Sepsis	7	1	.....	..
Pyelonephritis	6	15	3 (3.7%)	29
Coronary occlusion	3	2	2 (2.5%)	..
Anesthesia	2	..	.....	..
Lung abscess	1	..	.....	..
Metastatic carcinoma	1	5	2 (2.5%)	6
Decubitus ulcers	...	5	.....	1
Pulmonary tuberculosis	...	3	.....	..
Bronchiectasis	...	2	.....	1
Uremia	...	..	1 (1.25%)	..
Shock	...	..	1 (1.25%)	..
Meningitis	...	..	1 (1.25%)	..
Ruptured abdominal aneurysm	...	..	1 (1.25%)	..
Hepatitis	...	..	1 (1.25%)	1
Mediastinitis	...	..	1 (1.25%)	..
Intraperitoneal hemorrhage	...	..	1 (1.25%)	..
Acute pancreatitis	...	..	1 (1.25%)	..
Intestinal obstruction	...	..	.....	5
Cirrhosis of liver	...	..	.....	3
Intraabdominal abscess	...	..	.....	2
Infarct abdominal viscera	...	..	.....	2
Pleural effusion	...	..	.....	2
Lipoid pneumonia	...	..	.....	1
Intraabdominal visceral fistula	..	..	.....	1
Cystitis	...	..	.....	3
Cholelithiasis	...	..	.....	6
Chronic pancreatitis	...	..	.....	1
Acute pancreatitis	...	..	.....	1
Total	100	..	80 (100%)	..

* Deaths occurred within 1 mo. after operation.

Reference to Tables I and II elicits observations which can be briefly summarized as follows:

Bronchopneumonia, peritonitis and cardiac failure with accompanying pulmonary edema were the principal causes of death in a little more than half the patients. Other important causes were thrombosis and embolism, and pyelonephritis. Among the impressive contributing causes of death were pyelonephritis, often unsuspected, metastatic carcinoma, intestinal obstruction, bronchopneumonia, intraabdominal abscess, infarcts in abdominal viscera, cystitis, cirrhosis of the liver, hepatitis, decubitus ulcers and pleural effusion. It is difficult to explain the rise in deaths from bronchopneumonia during 1946 to 1952, unless longer life after operation increased susceptibility to the factors which predispose to that disease.

Deaths following gastrointestinal operations were caused chiefly by bronchopneumonia and in some instances by peritonitis resulting from existing perforation at the time of operation or from subsequent disruption of suture lines. Intestinal obstruction from various causes came to operation too late and too often from procrastination because of difficulty in diagnosis or conservatism. Palliative decompression operations were of no avail. Inoperable carci-

TABLE II

CAUSES OF DEATH ACCORDING TO SYSTEMS, 1946 TO 1952*

	Gastro-intestinal	Extremities	Genito-urinary	Biliary Tract	Neurologic	Pancreas	Female Genitalia	Respiratory	Circulatory
Principal									
Bronchopneumonia	9	4	9	5	3	..	..	1	..
Cardiac failure	3	2	1	2	..	..	..	..	..
Pulmonary edema	2	1	3	..	..	..	..	..	..
Peritonitis	7	..	2	2	..	..	1	..	..
Thrombosis and embolism	2	4	1	..	..	..	..	..	1
Pyelonephritis	..	..	3	..	..	..	..	..	..
Coronary occlusion	..	1	..	1	..	..	..	..	..
Metastatic carcinoma	2	..	..	..	..	..	..	..	..
Uremia	..	1	..	..	..	..	..	..	..
Shock	..	1	..	..	..	..	..	..	..
Meningitis	..	1	..	..	..	..	..	..	..
Ruptured abdominal aneurysm	1	..	..	..	..	..	..	..	..
Hepatitis	..	..	..	1	..	..	..	..	..
Mediastinitis	1	..	..	..	..	..	..	..	..
Intraperitoneal hemorrhage	..	..	..	..	..	1	..	..	..
Acute pancreatitis	..	..	..	..	..	1	..	..	..
Total	27	15	19	11	3	2	1	1	1
Contributory†									
Pyelonephritis	9	7	8	5	..	..	..	..	..
Metastatic carcinoma	2	..	1	1	1	1	..	..	..
Cholelithiasis	1	2	1	..	..	1	..	..	..
Intestinal obstruction	2	..	..	2	1	..	..	..	..
Cirrhosis of liver	1	..	..	..	..	..	1	..	1
Cystitis	..	..	3	..	..	..	..	..	..
Bronchopneumonia	1	..	..	1	..	..	..	..	..
Intraabdominal abscess	1	..	1	..	..	..	..	..	..
Infarct abdominal viscera	1	1	..	..	..	..	..	..	..
Pleural effusion	1	..	..	..	..	..	..	1	..
Pulmonary edema	1	..	..	..	..	..	..	..	..
Thrombosis	1	..	..	..	..	..	..	..	..
Decubitus ulcer	..	1	..	..	..	..	..	..	..
Bronchiectasis	..	1	..	..	..	..	..	..	..
Acute hepatitis	..	..	1	..	..	..	..	..	..
Lipoid pneumonia	1	..	..	..	..	..	..	..	..
Intraabdominal visceral fistula	1	..	..	..	..	..	..	..	..
Chronic pancreatitis	..	..	..	1	..	..	..	..	..
Acute pancreatitis	..	..	..	1	..	..	..	..	..

* The findings common to practically all the autopsy records were varying degrees of arteriosclerosis, valvular defects, coronary sclerosis, and myocardial, renal and liver damage.

† Additional contributing causes were varicose ulcers, old myocardial infarct, atelectasis, adhesive pericarditis, diabetes mellitus, pernicious anemia, nephrolithiasis, perinephric abscess, Hodgkin's disease, polycystic degeneration of pancreas, local peritonitis, hemorrhage from brain, hydronephrosis, aortic aneurysm.

noma accounted for other deaths. One patient with acute appendicitis succumbed to aspiration pneumonia. Other deaths were caused by cardiac failure, pulmonary edema, pulmonary embolus, metastatic carcinoma and a ruptured abdominal aneurysm.

and septic meningitis probably resulting from severe decubitus ulcers. One patient who had a midthigh amputation for diabetic gangrene died of shock on the operating table.

Two patients with brain tumors, one metastatic and the other recurrent, had surgical

TABLE III

MAJOR OPERATIONS ON SUBSTANDARD RISK PATIENTS SIXTY YEARS AND OVER*

Period	No. of Major Operations		Per cent Emergency of Total	Postoperative Deaths within 30 Days		Per cent Mortality Rate	
	Total	Emergency		Total	Emergency	Total	Emergency
1946	131	32	24.4	25	16	19.1	50
1947	162	44	27.2	23	12	14.2	27.3
1948	193	41	21.2	25	11	12.9	26.8
1949	199	56	28.1	34	18	17.1	32.1
1950	141	54	38.3	27	18	19.1	33.3
1951	112	36	32.1	17	9	15.18	25
1946–1951	938	263	27.2	151	84	16	32
1939–1945	616	91	14	142	49	23	53.8

* Postoperative mortality rates within 30 days.

Among the patients who had operations on the genitourinary tract, the major causes of death in numerical order were bronchopneumonia, kidney and bladder infection. Of thirty-two patients with pyelonephritis, three succumbed from that disease. Others died from pulmonary edema or peritonitis. One of the latter patients was operated upon for intestinal obstruction but autopsy showed a perforated diverticulum of the bladder. Another had a disruption of suture lines in a ureterointestinal anastomosis. Several patients died after cystoscopy, but enough severe pathologic changes already existed to explain death without the procedure. Other deaths followed cystotomy and here also the patients would have died without this operation from long-standing kidney infection.

The major cause of death after operations for biliary tract disease was bronchopneumonia. In this category two patients died of cardiac failure, two of peritonitis and one of hepatitis.

Patients who had midthigh amputations for arteriosclerotic gangrene or thrombosis of large vessels died mostly from massive thrombosis of intraabdominal or intrathoracic vessels. Other causes of death among those who had extremity operations were cardiac failure, coronary occlusion, pulmonary edema, uremia

TABLE IV

SEX AND AGE DISTRIBUTION*

Decade	Male	Female
7th	26	2
8th	30	7
9th	9	3
10th	1	2
Total	66	14

* Oldest patient, 94 years; average age both sexes, 72 years.

therapy to give symptomatic relief. One died of bronchopneumonia, the other of subarachnoid hemorrhage. Another patient had operative therapy for a transverse myelitis from unsuspected metastases to the spine. He died of bronchopneumonia.

There were two radical resections of the head of the pancreas for carcinoma. One of these patients succumbed from portal vein hemorrhage. Radical operation was contraindicated because lung metastases were found which had not been diagnosed. The other patient died of acute pancreatitis.

There were miscellaneous deaths which are recorded in Table II.

Possible Reduction of Mortality. In every well organized hospital preoperative preparation and postoperative care have become standardized to meet the requirements for the best service and support to the patient. The various methods to help reduce operative mortality in the aged have been discussed elsewhere.[1a–d] They include establishment of a correct diagnosis, prompt preparation for early therapy for acute surgical conditions, maintenance of chemical balance and blood volume, adequate control of diabetes, preoperative digitalization, the proper use of antibiotic therapy and chemotherapy, the correct timing of the operation, the interdiction of elective operative procedures on hot, humid days, a correct psychologic approach to the patient, good anesthesia, skillful and gentle operative technics, interdiction of the use of refrigeration anesthesia with tourniquet because they predispose to thrombosis from direct and thermal trauma to diseased blood vessels and soft parts,[1e] early ambulation, adequate oxygenation, early recognition of phlebothrombosis, thrombophlebitis and embolism, and prophylaxis against decubitus ulcers. Among other specific recommendations are cholecystostomy as opposed to cholecystectomy, brief and not prolonged tube decompression before surgical therapy for intestinal obstruction, appendectomy for acute appendicitis wherever possible,[1f] operative fixation of intracapsular and intertrochanteric fractures of the femur and operative closure of midthigh amputations for arteriosclerotic and/or diabetic gangrene[1e] unless there is obvious ascending infection or thrombosis of a major vessel. In patients who are in bad condition it is safer, if possible, to do just enough to give relief and to tide the patient over until a more favorable time when additional therapy may be used. This does not mean that multiple stage operations are advocated if the patient's condition warrants a single procedure.

SUMMARY

Eighty consecutive autopsy records in the various systems are analyzed among patients sixty years and over who died within one month after elective and emergency surgery at the Goldwater Memorial Hospital, the population of which consists chiefly of chronically ill geriatric patients who are extreme substandard surgical risks. These cases occurred between the years 1946 and 1952, when the antibiotics were available and when there was also improvement in various types of supportive therapy. The males predominated in a proportion of about 5:1, and a little less than half of all patients were in the eighth decade. In a previous communication 100 autopsies between the years 1939 and 1945, the chemotherapeutic period, have been analyzed and discussed. The pattern of the principal and contributory causes of death was similar in both groups although the mortality rate among all operated cases dropped 7 per cent in the elective and 21 per cent in the emergency cases in the antibiotic period. The outstanding principal causes of death in the present study were bronchopneumonia and peritonitis, and cardiac failure with accompanying pulmonary edema in a little over half the cases. During this same period there was a diminution in the number of deaths from cardiac failure, sepsis, and peritoneal and kidney infection. It is difficult to explain the rise in deaths from bronchopneumonia unless it can be attributed to a longer life after operation and therefore increased susceptibility to the factors which predispose to bronchopneumonia. Other important causes of death were thrombosis and embolism, and pyelonephritis. Among the impressive contributory causes of death were pyelonephritis and cystitis, metastatic carcinoma, intestinal obstruction, intraabdominal abscess, infarcts in abdominal viscera, cirrhosis of the liver, hepatitis, decubitus ulcers and pleural effusion. Most of the deaths after gastrointestinal operations were caused by bronchopneumonia, peritonitis and cardiac failure; after biliary tract operations by bronchopneumonia, cardiac failure and peritonitis; after genitourinary operations by bronchopneumonia, cardiac failure and pulmonary edema, pyelonephritis and peritonitis; and after extremity operations by thrombosis, bronchopneumonia and cardiac failure.

Some of the factors which precipitated the deaths were analyzed. Among the more important was the increased risk in emergency surgery, with mortality about twice that of elective surgery, especially when patients came to operation too late. They had rapid deterioration and often irreversible changes or shock which supportive therapy could not combat. Other factors were accompanying multiple degenerative diseases, errors in diagnosis and

technics and contraindicated technics. Surgical errors in chronically ill geriatric patients are costly. Their diminished homeostasis and reserve are not comparable with the better repair and vital processes and recuperative powers in younger, healthier people. Mortalities tend to increase with advancing years.

Suggestions are made for possible reduction of operative mortality. These include the proper and intensive antibiotic and supportive therapy and indicated operative management. In emergency surgery, especially if the patient is in poor condition, it is safer, if possible, to do just enough to give the patient relief and tide him over until such time as his improved condition warrants additional surgical therapy.

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About two-thirds of all patients with cancer of the uterine fundus can be saved, especially if there is preliminary radiation (internally and externally) and then radical surgery (panhysterectomy). Postoperative radiotherapy is less effective and reliance on radiation alone gives poorest results although it is best in poor risk cases and in those in which the corporeal cancer has extended beyond the uterus. Only in the hands of men like Brunschwig can one recommend partial or complete pelvic exenteration in these latter cases. (*Richard A. Leonardo, M.D.*)

Factors Influencing the Morbidity and Mortality in Burns

ELLIOTT B. HAY, M.D., *Diplomate, American Board of Surgery*, AND THOMAS D. CRONIN, M.D., *Diplomate, American Board of Plastic Surgery, Houston, Texas*

IN a review of 505 burns treated at the Jefferson Davis, Hermann and St. Joseph Hospitals between January, 1940, and January, 1950, it was found that the main factors influencing the morbidity and mortality was the extent of body surface burned, the types of burn, and associated injuries.

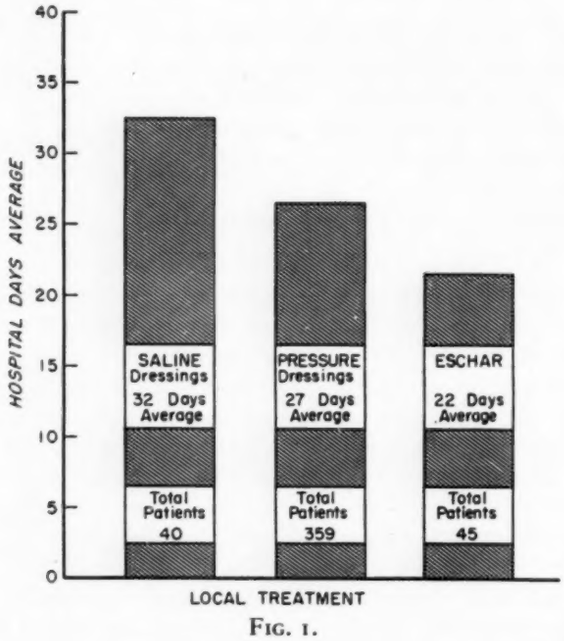


FIG. 1.

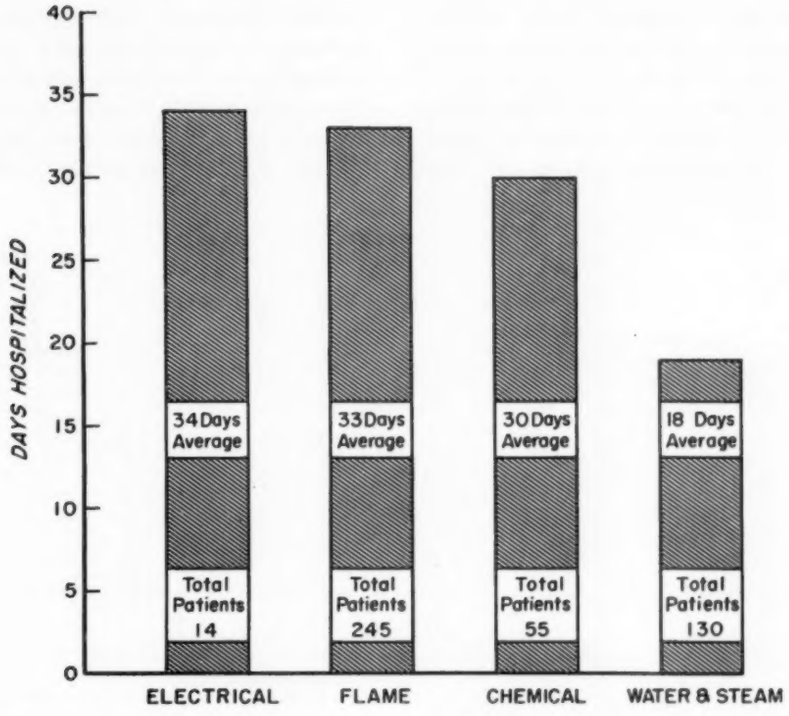
In Figure 1 the effect of local treatment consisting of saline compresses, pressure dressing and eschars on hospital stay are shown. It is noted that there is very little difference between days hospitalized when these types of local therapy were used. We do not believe that the shorter duration of hospitalization with eschars is sufficient to be of statistical significance.

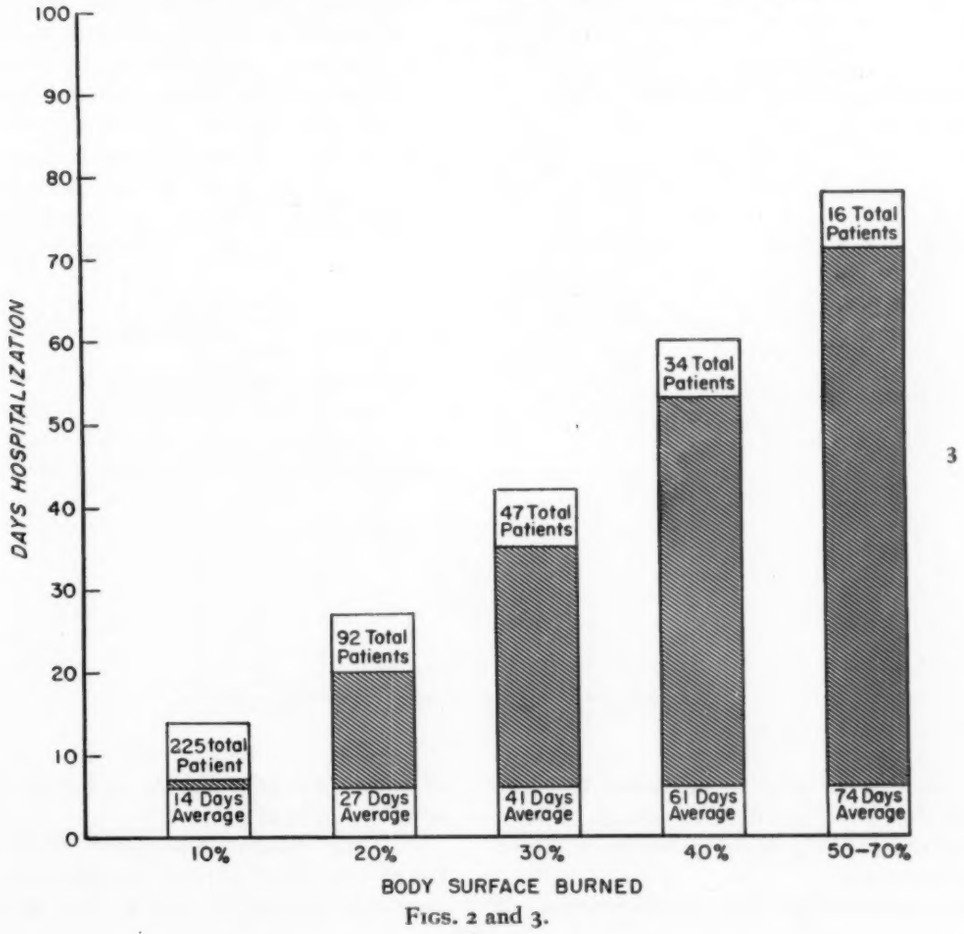
Figure 2 shows the relationship of the type of burns; electrical, flame, chemical and water and steam to the days hospitalized. Electrical burns are usually deep third degree, and although these patients were discharged after an average of thirty-four days' hospitalization, the wound frequently takes much longer to heal. The difference between days of hospitalization with flame burns when compared with those caused by water and steam does appear to be of statistical significance. The probable reason is that flame burns are more likely to be of greater extent and depth and are more frequently associated with other injuries because of the effects of explosion. This has also been found true by others.[1]

Figure 3 shows the relationship of the percentage surface body area burned, and the days of hospitalization. Hospitalization stay increased steadily with body surface area burned. The percentage surface body area burned appears to a major factor in morbidity when judged by the length of hospitalization. Those patients who died in the first twenty-four hours after admission were not used in the construction of Figures 1 to 3.

Figure 4 shows the number and percentage of deaths associated with flame, water and steam, chemical and electrical burns. The mortality rate was higher with flame than with water and steam burns and there was no mortality associated with electrical burns. Although an occasional patient survives in the hospital a few hours following severe electrical burns, most of the patients with extensive electrical burns do not survive to reach an institution so that the low mortality associated with these few electrical burns is probably not of great significance. The difference in mortality associated with flame and water and steam burns does appear to be significant as has been found by others.[1]

Figure 5 shows the relationship of the extent of body surface area burned and survival, and demonstrates a steady increase in mortality associated with the increase of the body surface

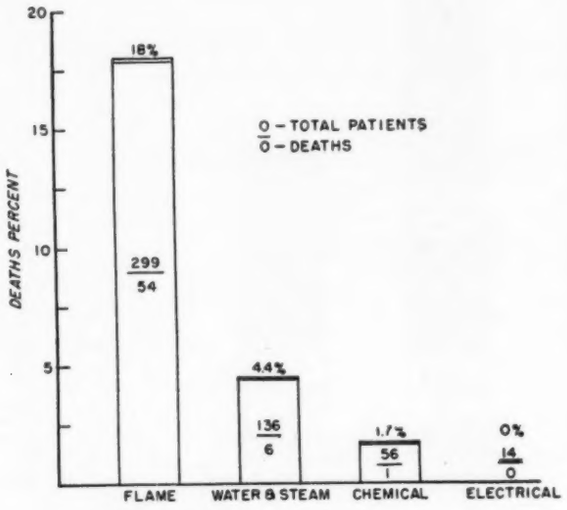

DAYS HOSPITALIZED
40
35
30
25
20
15
10
5
0
34 Days Average
33 Days Average
30 Days Average
18 Days Average
Total Patients 14
Total Patients 245
Total Patients 55
Total Patients 130
ELECTRICAL
FLAME
CHEMICAL
WATER & STEAM


DAYS HOSPITALIZATION
100
90
80
70
60
50
40
30
20
10
0
225 total Patient
14 Days Average
92 Total Patients
27 Days Average
47 Total Patients
41 Days Average
34 Total Patients
61 Days Average
16 Total Patients
74 Days Average
10%
20%
30%
40%
50–70%
BODY SURFACE BURNED

FIGS. 2 and 3.

area burned. The percentage of body surface area burned appears to be the major factor in the determination of mortality.

Figure 6 is a tabulation of the relationship of body surface area burned, causative agent and mortality. The numbers above the line



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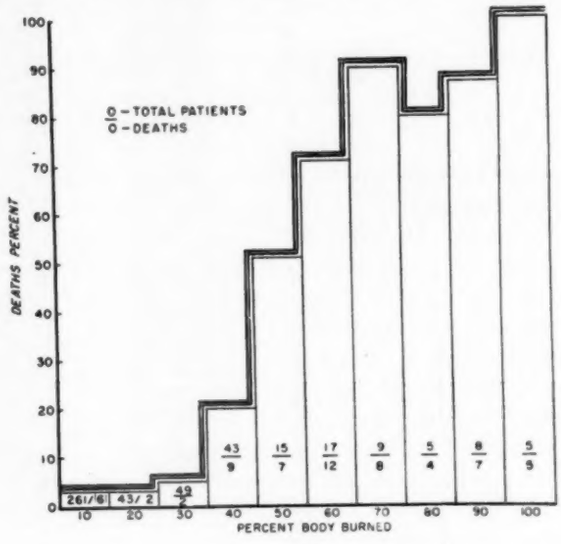

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FIGS. 4 and 5.

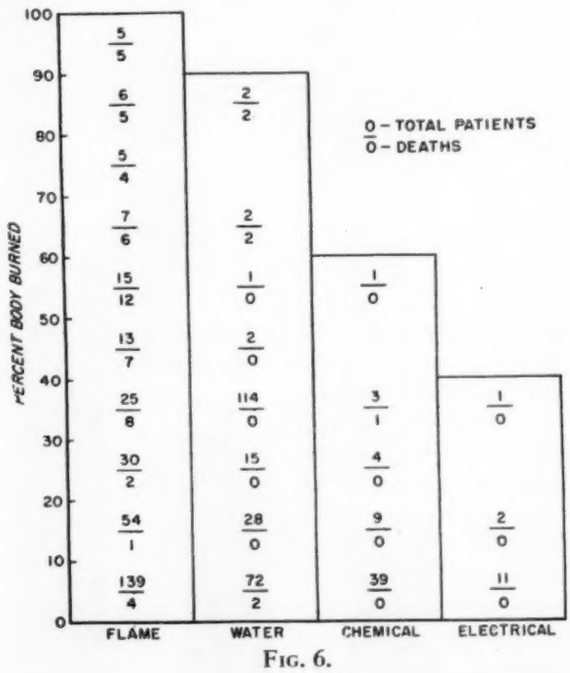

FIG. 6.

are the total burns and those below the line represent the fatalities in each group. Flame burns are more likely seen to injure a larger body surface area.

Figure 7 shows the time of occurrence of burned deaths in this series. The high percentage of deaths in the first seventy-two hours is usually due to shock. Those deaths occurring during the next few days are usually classed as toxemic, the etiology still being obscure but shock is probably of primary importance. Most of the late deaths shown in Figure 6 were the result of infection.

All the deaths associated with extensive burns and blast injury are probably not preventable. However, early skin grafting and

application of the principles demonstrated by recent work[2–4] on the physiology of chronic illness may aid in reducing the number of deaths from prolonged infection associated with extensive burns. The use of knowledge based on investigations of the treatment of shock and its sequela may reduce the number of deaths that occur early.[5–7] The need for whole blood and proper administration of electrolytes and fluids is becoming increasingly appreciated. We have found that about 50 cc. of blood and 50 cc. of plasma are required as replacement therapy for each 1 per cent body surface area burned.[8] The effect of cortisone in decreasing morbidity and mortality can only be evaluated with further experience.

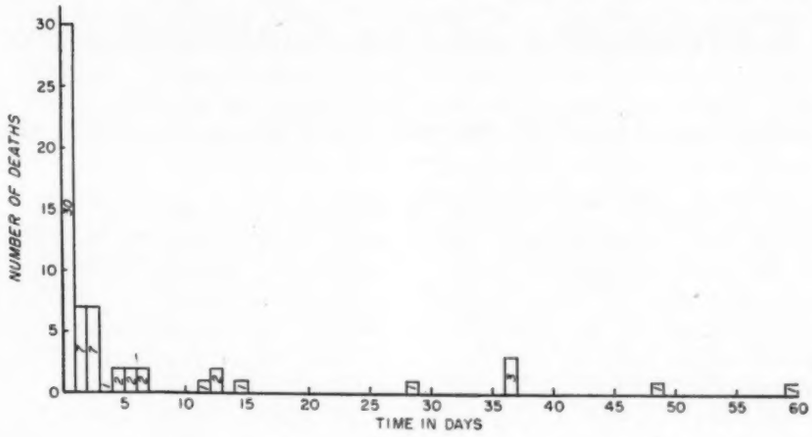

FIG. 7.

SUMMARY

In an analysis of 505 burns the major factors of determining the morbidity and mortality were found to be the type, depth and extent of the burn, shock and its sequela, and infection.

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Clinical Significance of Thickened Hepatoduodenal Ligament in Infiltrative Carcinoma of the Gallbladder

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CARCINOMA of the gallbladder was first described in 1771 by de Stoll. Since that date the literature to 1951 has contained approximately 2,400 cases. This report adds six cases to the list and will call attention to an important finding in this series which may be a helpful surgical diagnostic sign.

Infiltrative carcinoma of the gallbladder is a diagnosis made by the pathologist, not the surgeon, in the majority of cases. Primary carcinoma of the gallbladder is usually the infiltrative type productive of a diffuse thickening of the bladder. An obvious local mass such as is palpable and visible in gastrointestinal malignancies is not present to herald the diagnosis in carcinoma of the gallbladder. The gallbladder is grossly diseased and closely resembles the thickening associated with chronic cholecystitis. The correct diagnosis will be made in the rare bulky papillary type of growth, of which there was one in this series, or in the occasional case with obvious metastatic peritoneal implants. Liver metastasis will always occur in the course of this disease but not one of these cases had spread that involved the surface of the hepar. Usually the surgeon cannot know at the operating table that a diseased gallbladder is cancerous unless one of the foregoing exceptional findings is present.

However, there is one gross finding in these cases that is distinctive and, perhaps, pathognomonic. It is the observation that the hepatoduodenal ligament is a brawny, densely thickened structure that is swollen many times its normal size. In the earlier cases this was considered to be an edema associated with an inflammatory gallbladder. However, in subsequent cases that were truly acute and chronic cholecystitis the ligament was carefully inspected and found to be normal or slightly thickened but soft and pliant. With this in mind when the last two cases herewith reported presented a brawny hepatoduodenal ligament, a clinical diagnosis of carcinoma of the gallbladder was made and pathologic studies proved the presumptive diagnoses to be correct.

Incidence. In necropsy reports of all deaths the incidence of this disease in the University of Michigan Hospital[1] is 0.23 per cent in 11,614 autopsies performed; a total of twenty-seven cases of primary malignancy of the gallbladder was found. The necropsy reports of twenty-three different authors analyzing 206,098 cases of all conditions showed 908 primary carcinomas of the gallbladder and an average incidence of 0.43 per cent.

The frequency of this disease in relationship to other types of malignancy is 4.53 per cent.[2] In 13,803 cases of carcinoma found during necropsy examinations there were 616 of cancer of the gallbladder.

Moving from the postmortem room to the operating room where 46,480 surgical procedures on the biliary tract were collected from the literature, primary carcinoma of the gallbladder may be expected to be found in one case of a hundred. The exact figures collected by Arminski[3] show 569 cases of gallbladder malignancy in 46,480 operations, or an incidence of 1.12 per cent.

Etiology. The etiology of the disease is unknown. The obvious culprit is the gallstone. In a review of 2,067 cases of primary carcinoma of the gallbladder, stones were found in 1,514 or 73.2 per cent. Many authors found calculi in all of their cases but Gray and Sharpe[4] found them in only 50 per cent of their 291 cases. Investigative work is inconclusive. Petrov and Krotkina[5] introduced foreign bodies, as glass beads, into the gallbladders of

100 guinea pigs. Fifty-one animals survived fourteen months or longer, and of these five developed carcinoma of the gallbladder. On the other hand, Burrows[6] put gallstones and other foreign bodies into the gallbladders of fifty guinea pigs who were kept alive for one year or longer and autopsy did not reveal a single case of cancer. Ewing[7] did not favor the calculi theory. He believed that infection was important and that the inflammation plus other disturbing factors such as the irritating action of bile and disordered cholesterol metabolism excited cellular hyperplasia and anaplasia.

Patbology. Malignancy of the gallbladder may be divided histologically into the group of tumors resembling or derived from epithelium and the group originating in or resembling connective tissue. The epithelial tumors are by far the most frequent and present three distinct forms. The most common is the infiltrative type in which the wall of the gallbladder is infiltrated by tumor and thickened, resembling the diffuse infiltrative cancer of the stomach. Next most common is the colloid or mucoid type of tumor which is characterized by the formation of bulky primary or secondary masses of gelatinous, translucent tissue. Least common and most often resectable is the papillary type of tumor that grows into the bladder lumen.

The second group is difficult to classify, but cells resembling connective tissue, muscle, cartilage and bones can be identified. These tumors are exceedingly rare and the fifteenth case in the literature was reported by Fish[1] in 1951.

Patbogenesis. The liver is the earliest site of contiguous and metastatic spread of carcinoma of the gallbladder.[1] The subserosal plexus of lymphatics in the bladder is continuous with lymphatic channels in the overlying liver tissue and cancer will spread to the liver substance about the gallbladder fossa via the lymphatics as well as by direct extension and invasion. Another common route of extension is along the lymphatics accompanying the cystic duct. At its junction with the common duct, drainage occurs into the signal node of Lund and then to the liver along lymphatic channels around the common duct and vascular structures in the hepatoduodenal ligament. At a late phase miliary dissemination to other parts of the body occurs through the hematogenous route. Fish observed metastases to lymph nodes about the aorta and pancreas in approximately 15 to 20 per cent of the cases.

Clinical Picture. Carcinoma of the gallbladder is a disease whose diagnosis comes as a surprise to both surgeon and internist who have recommended cholecystectomy for routine cholelithiasis accompanied by acute and chronic cholecystitis. In over 50 per cent of the cases preoperative plans for common duct exploration have been made to remove the stone or detritus that is causing jaundice. Carcinoma of the head of the pancreas is not seriously considered because the element of pain is a leading symptom and is accompanied with some signs of peritoneal irritation in the right upper quadrant.

Arminski has analyzed 1,062 cases reported in the literature and the following parenthesized percentages were computed to be the incidence of common clinical symptoms and signs in primary carcinoma of the gallbladder. The composite patient is usually a woman (73.1 per cent) who has passed her fortieth birthday (93.6 per cent) and has cholelithiasis (73.2 per cent). The past history will suggest the presence of biliary disease, for she will have had dyspepsia, sensitivity to fried and fatty foods and colic (52 per cent). The patient's history will feature pain (76.1 per cent). The pain will be in the epigastric and right subcostal region and it may radiate to the back or be referred to the scapular region. Jaundice may be present (57.7 per cent) and a mass palpable in the right upper quadrant (53.2 per cent). Anemia is usually not marked but a recent weight loss is noted (64.1 per cent).

The signs and symptoms in this composite case do not differ from the garden variety of gallbladders routinely removed for stone and infection. The systemic clues of weight loss and anemia may be present and can suggest malignancy to a wary clinician. However, neither sign is pronounced and one is reluctant to postulate seriously such a diagnosis because anemia and some weight loss does occur in patients who are observing restricted, low fat diets. The only suggestions that neoplasm is present are vague and unsatisfactory. They are clouded or completely veiled by the clear-cut presenting picture of cholecystitis and cholelithiasis with which it is associated and to which it is believed by some authorities to be secondary.

CASE REPORTS

CASE I. J. J. (No. 23547), a sixty-one year old white woman, was admitted to the Jewish Memorial Hospital in June, 1942. She gave a history of gallbladder disease for twenty years. For two weeks prior to admission she had had epigastric pain associated with nausea and vomiting. Jaundice and increasing lightness in the color of the stool had been noted for one week.

Examination revealed a well developed woman whose only abnormal physical finding was intense jaundice. No masses or tenderness were elicited on abdominal examination. The liver edge was palpated just below the costal margin.

Laboratory data disclosed bile and urobilinogen in 1:10 dilution in the urine and acholic stools which were 3+ for occult blood. The icteric index was 70. The hemoglobin was 90 per cent and the red blood count was 4,470,000.

Operation revealed a thickened wall, tense gallbladder whose body was firmly adherent to the omentum and duodenum. Its lumen contained stones and white bile. The common duct was dilated and contained yellow bile. A probe passed easily up to the porta hepatis and into the duodenum without encountering stone or obstruction. The entire hepatoduodenal ligament was thickened and edematous. The liver was smooth-surfaced and slightly enlarged. A cholecystectomy and T-tube drainage of the common duct were performed.

Microscopic examination of the gallbladder disclosed a replacement of the mucosa by atypical glandular acini. There was marked disorientation of the nuclei of the cells which invaded all layers of the gallbladder wall.

The patient's postoperative course was characterized by progressive asthenia and she expired three weeks after discharge from the hospital.

CASE II. M. C. (No. 159357), a sixty-seven year old white woman, was admitted to the New York City Hospital in July, 1948. She had had a partial cholecystectomy for gangrenous cholecystitis in 1940 at another hospital. She was discharged from that hospital on the fortieth postoperative day and thereafter had remained well for seven years. In 1947 a circumscribed area in the wound became red and painful. She was readmitted to the original hospital and the area was incised releasing pus. A persistent mucopurulent discharge was treated for several months in a clinic and the patient was admitted to the New York City Hospital in July, 1948, for treatment of this sinus tract. The tract was located in the center of an upper right rectus incision and was just big enough to admit a probe for a distance of 3 inches. A small amount of yellowish pus could be expressed from the sinus opening. There was no history of jaundice.

The gallbladder could not be visualized on x-ray after the ingestion of dye. The hemoglobin was 78 per cent and the red blood count was 4,020,000; albumin 3.4 and globulin 2.0.

At operation the tract was excised with a transverse elliptic segment of skin. The right upper quadrant was a mass of plastic adhesions, matting all the organs in the region. The tract led into the fundus of a small, pear-shaped stony hard gallbladder whose lumen would admit only a probe that passed through the cystic into the common duct. The common duct was enormously dilated and thin-walled. A few small glands were palpated in the hepatoduodenal ligament. The liver was grossly normal. The gallbladder was removed without difficulty.

Pathologically, the gallbladder measured 6 cm. in length and 3 cm. in greatest diameter. At the fundus the lumen communicated with a sinus tract which was ringed with skin. The specimen had been previously open for inspection and revealed a yellow-brown, granular mucosal surface. The wall was markedly thickened and fibrous, measuring 112 cm. in some areas. On microscopy the wall was markedly thickened and fibrous. There was almost complete erosion of the mucosal surface which was covered by debris and necrotic material. The wall was massively invaded by acinar and solid cords of atypical epithelial cells which varied in size, shape and staining quality. Diagnosis: extrabiliary fistula and cholecystitis; adenocarcinoma of the gallbladder.

The patient's postoperative course was uneventful. She reported to the clinic for checkups for a period of one month and was then completely lost to follow-up study.

CASE III. A. P. (No. 89050), a fifty year old obese white woman, was admitted to the Jewish Memorial Hospital in April, 1951. She had had epigastric and right upper quadrant discomfort following the ingestion of fried and fatty foods for a period of twenty-five years. Three years before she had one attack of very severe colic. Following a very indiscreet meal three weeks

before admission she had unrelenting epigastric discomfort and indigestion. The low grade distress continued and for the week prior to admission it was associated with jaundice, dark urine and light brown to clay-colored stools.

Examination revealed fairly deep golden brown jaundiced skin covered with scabs of scratch marks. Tenderness to deep pressure was elicited in the right upper quadrant but no mass was palpated. The liver was slightly enlarged.

Laboratory data included hemoglobin of 11.2 gm., red blood count 3,630,000, with normal white and differential counts. The bleeding, coagulation and prothrombin times were within normal limits. The icteric index was 53. Cholecystograms taken a few days before hospital admission showed a non-filling gallbladder.

Laparotomy disclosed the gallbladder to be markedly thickened, tense and grayish white in color and it contained numerous stones. The entire hepatoduodenal ligament was densely thickened. A slightly enlarged common duct was opened and negative flushes and instrumentation were performed. Cholangiogram on the operating table was negative. Cholecystectomy and T-tube drainage of the common duct were done.

The pathologist reported a gallbladder 8 by 4 by 1 cm. with thickened walls containing four facetted stones. Microscopy of the gallbladder showed marked fibrous and round cell infiltration of the wall. Within the wall there were small cystic spaces consistent with Aschoff sinuses but within these the epithelium showed marked papillary hypertrophy with cytologic atypism. Such papillary glandular accumulations were also found in other areas. Some of the lymph spaces were filled with tumor fragments. Diagnosis: papillary adenocarcinoma.

The patient ran a normal postoperative course for five days. Thereafter until discharge four weeks later when she was flown home to California, the illness was characterized by recurrent septic temperature, chills, sweats and increasing weakness. Despite moderate biliary drainage through the T-tube the jaundice, which at first diminished, never completely disappeared. Needle biopsy of the liver at this stage showed extensive acute pericholangitis with hepatitis. Intensive antibiotic therapy was of no value. On arrival at home five weeks after surgery the patient was admitted to the Cedars of Lebanon Hospital where she died. Autopsy revealed blockage of the left hepatic duct by tumor tissue, numerous metastatic liver implants and multiple liver abscesses.

Case IV. P. B. (No. 27523), a forty-eight year old Negro woman, was admitted to the New York City Hospital in April, 1951. She had had sharp, intermittent, stabbing pain in the epigastrium, radiating to the back, for a period of two weeks. The pain was associated with nausea and occasional vomiting. No history of jaundice was obtained.

Examination revealed marked epigastric and moderate right upper quadrant tenderness in an obese female. In x-ray examination, following the ingestion of dye, the gallbladder was not seen. The icteric index was 9 on June 1, 1951, and was reported to be 8 three days later. Cholesterol was 270 and the cholesterol esters 184.

Surgery disclosed a hard, fixed mass measuring 5 by 3 by 2 inches occupying the region of the gallbladder. The mass was whitish in color, gritty in consistency, friable and vascular. The mass extended into the hepatoduodenal ligament and the falciform ligament. Miliary seeding of the parietal peritoneum was noted. No gross liver metastasis was observed.

Biopsy revealed the normal architectural pattern of the gallbladder to be replaced by diffuse infiltrating carcinoma with an associated scirrhous reaction. Squamous metaplasia was a prominent feature. The patient died in the second postoperative week.

Case V. E. L. (No. 33392), a sixty-five year old white woman, was admitted to the New York City Hospital in December, 1951. She gave a three-week history of progressively increasing jaundice, whitish colored diarrheal stools, dark urine, icteric sclera, pruritis and abdominal discomfort with occasional nausea and vomiting. Anorexia and increasing weakness were also present.

Examination revealed a markedly jaundiced, well nourished woman who was not acutely ill. Abdominal examination was negative for tenderness or masses.

In the gallbladder series the organ could not be visualized. The urine was repeatedly positive for bile and negative for urobilinogen. The hemoglobin was 96 per cent and the red blood count was 4,470,000. The thymol turbidity was 5.0 and 4.0. Icteric index was 90 (December 7th) and 133 (December 17th). Cholesterol was 312 and cholesterol esters 158. The alkaline phosphatase was 10.8.

The patient was studied on the medical service and transferred to surgery with the diagnosis of extrahepatic biliary obstruction, most likely carcinoma of the head of the pancreas.

Laparotomy revealed a very thick-walled gallbladder containing two large stones. The hepatoduodenal ligament was diffusely thickened. The common duct was normal in size. A probe could be passed easily into the duodenum and for 2 inches cephalad to a mass 3 by 3 cm. in the porta hepatis overlying the right and left hepatic ducts. No bile was obtained from the common duct. A T-tube was inserted into the choledochostomy and cholecystectomy was performed. Cholangiograms revealed dye running into the duodenum but none into the biliary radicles.

The pathologist described a very large, dilated and extremely thick-walled gallbladder with a ragged mucosa. The cut surface was yellow in color. There were two large, hard stones with a few facets. Microscopy reported the mucosa to be almost completely replaced by neoplastic epithelium showing marked anisocytosis and hyperchromatosis but infrequent mitoses. The cells penetrated to the outer layer, forming glands frequently with abundant mucus. There was edema of the wall and a heavy mixed inflammatory reaction. Diagnosis: carcinoma of the gallbladder.

Postoperatively the patient went downhill rapidly. She died on the ninth day with cholemia, sepsis, oliguria, twitching, vomiting and increasing drowsiness. Postmortem examination revealed the following: metastatic carcinoma in the liver and porta hepatic lymph nodes, acute cholangiohepatitis, cholemia, acute bronchopneumonia, chronic pleural adhesions, atherosclerosis, splenomegaly and an ovarian cyst.

Case vi. H. R. (No. 95883), a stout fifty-one year old white woman, was admitted to the Jewish Memorial Hospital in April, 1952. She gave a history of cholecystotomy and removal of gravel twenty-eight years previously. During the past year she had had attacks of right upper quadrant pain radiating to the right lumbar region and sometimes to both shoulders. The attacks were associated with nausea and repeated vomiting. Intolerance to fatty foods and constipation were noted but never jaundice. A strict medical dietary regimen and antispasmodic therapy were unsuccessful.

Physical examination revealed some tenderness to deep pressure in the right upper quadrant. A hypertension of 210/110 was present.

X-ray of the gall bladder with dye showed no filling. A gastrointestinal series disclosed: (1) hiatal hernia, (2) prepyloric ulcer and spasm of the first portion of the duodenum, and (3) extensive diverticulosis. All liver function tests were normal. The hemoglobin was 96 per cent and the red blood count was 4,630,000.

Laparotomy disclosed a moderately enlarged, firm, thick-walled gallbladder with omentum adherent to the fundus. The ampullary portion of the gallbladder was densely adherent to the hepatoduodenal ligament and the upper border of the first portion of the duodenum. At the point of these adhesions the gallbladder wall had been completely eroded by one of three large stones in the bladder. The perforation was the size of a nickel and the stone rested on a fibrous bed in the ligament and bowel wall. The common duct was not visualized in the hepatoduodenal ligament which was uniformly thickened and brawny. Cholecystectomy was performed.

The pathologist reported a gallbladder measuring 8 by 3 by 3 cm. The wall was unusually thick. In the ampullary region there was a circular opening approximately 1½ cm. in diameter. On cut section the wall appeared to be fibrotic with a few granular white areas. Attached to the serosal surface some more patchy grayish yellow areas were seen. In the region of the neck the wall got even thicker and measured as much as 6 mm. in width. The cut surface was granular and gritty to the knife. Also included were three combination stones. Microscopy showed marked fibrosis of the wall of the gallbladder. In many areas there was infiltration of the wall by atypical glandular elements lined by cuboidal cells of varying size and shape, with marked atypism of nuclei and frequent atypical mitoses. The tumor extended into the adjacent liver tissue.

The postoperative course was complicated by mild bronchopneumonia and the patient was discharged on the twelfth day. She died at home in cholemia five months after the onset of her present illness.

COMMENTS

Analysis of these cases discloses that the usual criteria for diagnosis of cancer on gross inspection were present in the bulky papillary

carcinoma of the gallbladder in Case II and by the observation of peritoneal implants and a hard, fixed gallbladder mass in Case IV. In the remaining cases only a thickened gallbladder was observed and no suspicion of neoplasm by inspection of the gallbladder was entertained except in Case VI where the margin of the perforation of the gallbladder wall had a cartilaginous consistency. This gross finding could have been interpreted to be a narrow zone of marginal fibrotic scar tissue thickening but wariness of interpretation was suggested by the densely thickened hepatoduodenal ligament.

The hepatoduodenal ligament in presence of carcinoma of the gallbladder was found to be thickened from 1 to 2 cm. The usual pliant elasticity of the ligament is replaced by a solid denseness. This is probably due to infiltration of cancer cells into the lymphatic channels around the common duct and vascular structures in the ligament.

In surgery on the biliary tree it is suggested that the condition of the hepatoduodenal ligament be observed carefully for elasticity and denseness. In routine cholecystectomy the prognosis should be guarded if this ligament is markedly thickened and brawny. Routine palpation for common duct stones has familiarized surgeons with the usual consistency of this structure. **A marked change which makes palpation very difficult and unsatisfactory should suggest neoplasm of the gallbladder even though there is no extraordinary alteration in the bladder's appearance. The infiltrative cancer of the gallbladder looks like the thickened gallbladder of acute and chronic cholecystitis. If two of the four cases of this type in this series can be erroneously diagnosed grossly by surgeon and pathologist, the element of error is rather large**

The correct interpretation of a thickened hepatoduodenal ligament can be very helpful to the surgeon. Jaundice is present in 57.7 per cent of patients with malignancy of the gallbladder. It is incumbent upon the operator to try to find the reason for the cholemia, but this is impossible. The metastatic implants causing the blockage are buried intrahepatically or in a hepatic duct just outside the liver. Fruitless flushes of the common duct do not bring back detritus. The probe encounters no calculus and drops easily through the ampulla of Vater into the duodenum. The common duct exploration is surgically bewildering and is ended with the false conclusion that cholangitis and hepatitis are the basis of the jaundice. Cholangiogram during surgery, as in Case V, can demonstrate hepatic duct blockage. The interpretation of the cause of the obstruction will be made easier if primary malignancy of the gallbladder is suspected by the finding of a brawny hepatoduodenal ligament.

Suspicion of the correct diagnosis of these cases at the time of surgery will be most helpful in prognostication to the patient's family. If a thickened hepatoduodenal ligament is observed, a guarded prognosis should be given until confirmation or denial of suspicion is rendered by the microscopic study. The surgeon can avoid embarrassment of explanations to the family of why a patient who is expected to have a routine convalescence will instead rapidly deteriorate and die.

A third benefit from early operating room diagnosis is derived by the surgeon. In the postoperative period the persistence of cholemia despite common duct drainage will be understood rather than be a source of bewilderment. The same recognition will be given to severe sepsis that may ensue following surgery.

A truly thickened and brawny hepatoduodenal ligament seems to signify cancer of the biliary tree and in these cases specifically, the gallbladder. It is urged that other surgeons report their findings to corroborate or refute this observation.

CONCLUSIONS

Confronted with a case with cholelithiasis one should not be influenced unduly by the possibility of coexistent carcinoma because of the frequent association of stones with malignant gallbladders. The condition represents slightly more than 1 per cent of all lesions of the gallbladder found at operation. One can assume that it occurs in 3 per cent of all cases of cholelithiasis; and since this incidence is somewhat higher than the operative mortality, one could advocate routine prophylactic cholecystectomy. That would entail an enormous amount of surgery. In the age group between the fifth and eighth decades when the disease is most common the incidence of carcinoma of the breast is much greater but no one advocates prophylactic mastectomy. The decision for cholecystectomy must be based on the presence of non-malignant complications rather than

on the risk of carcinoma. These noncancerous complications of gallbladder calculi are acute and chronic cholecystitis, passage of stones into the common duct causing colic and biliary blockage, hepatitis, cholangitis and pancreatitis. The treatment of cholelithiasis when there are symptoms is generally agreed to be surgery. Lahey believes that the delay in treatment of cholelithiasis is the avoidable factor that results in many serious complications. The silent stones that are incidental findings on roentgenography may be left alone until they emerge from that category by reason of the onset of symptoms.

SUMMARY

1. Six cases of carcinoma of the gallbladder are reported.

2. The association of a brawny thickened hepatoduodenal ligament with infiltrating carcinoma of the gallbladder is noted.

3. Inasmuch as the lesion of this type of neoplasm may be indistinguishable by the surgeon and the pathologist on gross inspection from the acute and chronically inflamed gallbladder, a clear-cut clinical sign could be most helpful in diagnosis and prognosis.

4. Careful confirmatory observation and reports are requested.

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Prevention of Abortion

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FAILURE of adequate dosage of stilbestrol to prevent abortion, even in the frequently habitual aborter, is often due to deficiency of vitamin B factors or of vitamin C. Javert[1] demonstrated premature separation of the placenta followed by abortion in cases in which there was a lack of vitamin B complex and of vitamin C. It was further shown by Jailer[2] that a deficiency of the folic acid moiety of vitamin B interferes with the normal physiologic action of estrogens, including stilbestrol. For the complete utilization of oral stilbestrol, therefore, adequate concentrations of these vitamins are essential.

Frequently the added metabolic burden imposed by pregnancy makes necessary the administration of vitamins supplementary to those of the diet. For this purpose a convenient combination of estrogen and vitamins is found in desplex* tablets containing micronized stilbestrol, vitamin C and all the essential factors of the vitamin B complex including B_{12} and folic acid, indispensable in the intermediary metabolism of stilbestrol.

Results from the application of desplex in 200 pregnancies indicate the advisability of extending its use to include not only those patients known to have had previous abortions but also all other pregnant women, whether or not there is manifest evidence of threatening abortion or of vitamin deficiency.

The series reported herein consists of ninety primiparas and 110 multiparas, ninety of whom had had from one to seven miscarriages. Of these 200 pregnancies only two aborted under desplex therapy: One patient with a history of three miscarriages aborted a macerated fetus with decidual degeneration, and in one patient with five previous spontaneous abortions abruptio placentae developed at six and a half months necessitating cesarean section.

Dosage was determined by a consideration of the number of previous miscarriages and the period in pregnancy at which they took place. The dose was increased at the calculated periods when menstruation would have occurred, and was greatly augmented and often supplemented by the intramuscular injection of bio-des† with the appearance of symptoms suggesting threatening miscarriage, i.e., backache, lower abdominal tenderness, cramps or staining. Primiparas and patients who had had no previous miscarriages were given 25 mg. of desplex daily from the second to the fourth month, 50 mg. daily from the fourth to the sixth month and 75 mg. a day from the sixth month to term. Patients with histories of miscarriages were given 25 to 50 mg. daily through the first trimester, 100 mg. a day through the second trimester and 100 to 150 mg. daily thereafter to term.

In patients showing definitive symptoms of threatening abortion the dosage of desplex was increased to 300, 400 mg. and in a few cases to 500 mg. a day. In addition to this therapy, ten of the patients with most severe symptoms of impending abortion were given 25 mg. or more of bio-des intramuscularly every six hours until the symptoms were controlled.

These massive doses of micronized stilbestrol supplemented by vitamins B and C were remarkably well tolerated. Karnaky[3] found that the administration of vitamins B and C along with stilbestrol aided greatly in reducing the untoward reactions, nausea and vomiting, thus obviating loss of the drug by emesis and ensuring maximal estrogenic effect by complete metabolic utilization. Nausea and vomiting, so often encountered in the use of ordinary stilbestrol without vitamins, were absent, as was the frequently reported adverse effect of long-continued high dosage administration of

* Supplied through the Grant Chemical Company, Inc., New York, N. Y. Composition: micronized stilbestrol 25 mg., thiamine hydrochloride 2 mg., riboflavin 2 mg., pyridoxine hydrochloride 1 mg., ascorbic acid 50 mg., calcium pantothenate 10 mg., niacinamide 50 mg., folic acid 0.25 mg., vitamin B_{12} 0.5 μg.

† Bio-des, Grant Chemical Company, Inc., micronized stilbestrol in sesame oil, 25 mg. per cc.

natural or synthetic estrogens on increase in fetal size and weight. To the contrary, estimation of uterine size and volume and fetal weight up to the twenty-eighth week of gestation gave lower figures than in patients without estrogen therapy. After that point growth of the infant increased rapidly to normal.

The therapeutic regimen reported herein gave such encouraging results as to justify its routine use in all pregnancies; primiparous and multiparous without previous miscarriages as well as the more usually treated group of habitual aborters. It is true that not all will require this antiabortive therapy. However, in view of the impossibility of selecting those patients in whom abortion is to be anticipated and in view of the extraordinarily favorable results of losing but two of 200 pregnancies, general use of this treatment, to include some patients who would go to term without it, is fully justified.

Incidental to this series of 200 pregnancies were several patients routinely placed on the stilbestrol-vitamin regimen because of a missed period and erroneously presumed pregnancy. The high estrogen dosage continued the suspension of menstruation and it was six to eight weeks before it was discovered that a nonexistent pregnancy was being treated. This embarrassing situation, of course, can be avoided by establishing pregnancy by the Aschheim-Zondek or Friedman test before initiating therapy.

SUMMARY

Ninety pregnant habitual aborters with one to seven miscarriages, twenty additional multiparas and ninety primiparas were given daily massive stilbestrol therapy together with vitamin B factors and vitamin C. There was a loss of but two pregnancies (1 per cent), justifying general routine application of this antiabortion regimen in all pregnancies.

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The Second Side Inguinal Hernia and Routine Transpubic Exposure

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A PATIENT with a sound unilateral repair may return later with a new hernia on the other side. How often does this occur and what can be done to anticipate it? To gather data we reviewed the cases of inguinal hernia in Mercy Hospital, San Diego, in 1952. (Table 1.) There were forty-four second side hernias in the 397 male patients.

Inguinal hernia is basically a bilateral disorder. This is recognized in the direct type since most staff surgeons perform a routine bilateral repair. The etiology behind the direct hernia is a bilateral thinning of the fascia of the triangular area medial to the external ring. The bulge one feels is a mass of extraperitoneal fat under the thin fascia.

The need for bilateral repair in this type is apparent clinically, for one can feel an enlarged ring on the second side. This enlarged ring should be closed snugly about the cord at the time the hernia is repaired. Many direct hernias are discovered when the patient seeks employment in industry. If the hernia alone is repaired, the patient may still be rejected, for now the examiner will compare the tight repaired ring with the relaxed one on the second side and may classify the latter as a potential hernia. The patient with bilaterally enlarged rings and no symptoms does not have a hernia and should not have surgery until there is evidence of one side breaking down.

An inguinal hernia is due to congenital or acquired weakness of the inguinal canal. The hernia develops insiduously to a certain point and then, following some sudden strain, the patient experiences the clinical rupture. Force alone is merely the precipitating factor.[1] This insiduous development tends to be bilateral, with one side in advance of the other. The first side becomes a clinical hernia while the second may lag as a potential hernia. The potential direct hernia can be felt as a bulge, but the potential indirect hernia is within the inguinal canal and cannot be diagnosed by the examining finger. There are two main types of the latter. One type is an incompletely closed processus vaginalis peritonei which exists as a congenital unexpanded sac. The other type is acquired and exists as a mass of pedunculated fat lying along the spermatic vessels in the inguinal canal. Throughout the abdomen there is a layer of fatty areolar tissue adherent to the outer surface of the parietal peritoneum. The intra-abdominal pressure pushes this fatty tissue into any defect in the abdominal wall. If the internal opening of the inguinal canal becomes relaxed or dilated, this fat, and behind it the peritoneum, is pushed into the canal.

This mechanism of hernia production is especially common in patients with Bancroft's filariasis. They suffer recurrent attacks of lymphangitis, with swelling and edema of the spermatic cord. This swelling dilates the open-

TABLE 1

INGUINAL HERNIAS, MERCY HOSPITAL, 1952

	Total	Female	Male	Second Side Hernias	Recurrent Hernias
Infants under 1 yr.	32	4	28	3	0
Children aged 1–14 yr.	79	7	72	4	1
Adults	333	36	297	37	37
	444	47	397	44	38

Adult Males

	Total	Unilateral Repair	Bilateral Repair	Second Side Hernias	Recurrent Hernias
Direct type	69	19*	50	5	6
Early indirect (present under 1 yr.)	103	87	16	..	2
Late indirect (present over 1 yr.)	125	88*	37	32	27
	297	..	..	37	35

* Including second side hernias.

ing of the inguinal canal and permits entry of the fatty tissue. Filariasis affects both spermatic cords, so the findings are usually bilateral. From 1929 to 1939 I performed surgery in the tropics where this disease was hyperendemic. In these cases it was routine to do a bilateral exposure with every hernia or hydrocele. A high percentage had fatty masses in the contralateral canal; and since we were looking for it, an unexpanded congenital sac was not uncommon.

TABLE II
CONTRALATERAL FINDINGS IN UNILATERAL INDIRECT HERNIAS (TRANSPUBIC EXPOSURE)

Case	Age (yr.)	Symptoms	Findings on Second Side
1	45	4 mo.	Fat mass in canal
2	48	6 mo.	Small fat mass
3	39	4 yr.	No potential hernia
4	19	2 wk.	No potential hernia
5	20	Congenital	No potential hernia
6	3	Congenital	No potential hernia
7	43	Congenital	No potential hernia
8	42	Congenital	Relaxed external ring
9	49	2 mo.	Direct bulge, no sac
10	13 mo.	Congenital	Unexpanded sac, open tunica vaginalis
11	55	1 yr.	Fat mass in canal
12	26	2 wk.	No potential hernia
13	46	3 yr.	Fat mass in canal
14	24	1 mo.	Fat mass in canal
15	39	10 mo.	No potential hernia
16	61	6 mo.	No potential hernia

In hernia cases in San Diego I have been finding similar fatty masses in the inguinal canal, but with less frequency than in the filariasis cases. I have tabulated the contralateral findings in some personal cases of single indirect hernia seen in the past three years. (Table II.) The number is small and serves only to show that in some cases one may find a potential hernia.

Our interest, from the standpoint of the second side hernia, is in the early indirect type. We have divided these cases in our series into an early group and a late group, depending upon whether the hernia had been present less than a year or more than a year. There is a marked difference in these groups. In the early group were the small hernias which were not difficult to repair. In the late group over 50 per cent had become double hernias, and many were recurrent and stangulated. (Table III.)

Paradoxically, the earlier the hernia is operated upon, the greater is the likelihood of the second hernia. Every hernia is single if seen before there has been a test of time for the second one to appear.

TABLE III
FINDINGS IN INDIRECT HERNIAS IN ADULT MALES

Early group (present under 1 year):	103	
Unilateral repair, second side not exposed..	87	
Unilateral sac		79
Unilateral sac plus fat mass		5
Unilateral fat mass, no sac		3
Bilateral repair, clinical second side weakness	16	
Bilateral sac		3
Bilateral fat mass, no sac		2
Unilateral sac with second side weakness or fat mass		11
Late group (present over 1 year):	125	
Unilateral repair, second side not exposed..	88	
Unilateral sac		50
Unilateral sac plus fat mass		6
Unilateral repair, second side hernia		32
Bilateral repair, clinical second side weakness	37	
Bilateral sac		25
Unilateral sac, second side weakness or fat mass		12

Complications:	Early Group	Late Group
Strangulation, incarceration, sliding	0	12
Recurrent hernias	2	27

In the indirect cases in the series the surgeon exposed the second side only when there was some clinical evidence of second side weakness. In certain cases the operator mentioned lipomas or fatty masses in connection with the hernia sac. The incidence of this is of no statistical significance in this series since the operators did not specifically record the presence or absence of it. Speed,[2] Watson[3] and Krieg[4] have described these fatty masses. Speed in 1914 reported finding lipomas in connection with the hernia sac in seventy-three of 154 herniotomies. These masses are incorrectly called lipomas, for they are normal pedunculated fat rather than a new growth.

In our series there were seven second side hernias in infants and children. (Table I.) In five of these the sac extended down to form the tunica vaginalis testis, indicating that the sac had existed in the unexpanded state at the time of the first operation.

TECHNIC FOR TRANSPUBIC EXPOSURE

To anticipate the second side hernia, one must make a bilateral exposure. We start the

skin incision just lateral to the internal ring and curve it across to a similar point on the opposite side. (Fig. 1.) It passes directly along each inguinal canal and over both pubic spines. It curves with the skin folds and gives a good cosmetic scar, most of which will lie hidden in the pubic hair. This is a natural incision and its advantages have been described by Judd[5] and Shambaugh.[6] The latter points out that one need not divide the subcutaneous vessels over the pubis since these can be retracted quite readily. The main difference in the transpubic and bilateral oblique incisions is the extension across the pubis. This extra length however, enables better mobilization and wider exposure to the region of the external rings. This is very helpful in children and in adults requiring an extensive repair.

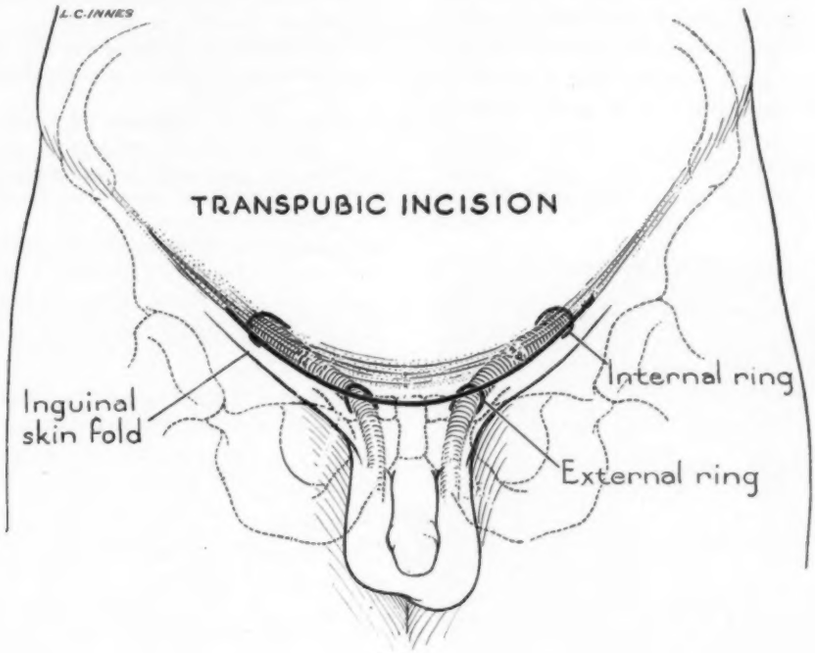

FIG. 1.

The principle behind the oblique incisions is that each is centered over the internal ring since, in the usual operation, the canal is opened here to identify the hernia sac. However, we must employ a different technic since we do not wish to open the canal unless we can first demonstrate a potential sac or a pedunculated fat mass. Opening the normal canal at the internal ring will expose normal extraperitoneal fat.

First we approach the pubic portion of the spermatic cord. The cord need not be lifted from its bed at the pubis. There is a plexus of veins here, outside the cord, which can be torn. The fascia of the cord is opened longitudinally up to the margin of the external ring. The components of the cord are then spread out for inspection. Traction on the vessels will bring down into view any unexpanded sac or any pedunculated fat lying in the canal. If neither is found, no further search is made. If the external ring seems to be relaxed, one or two figure-of-eight stitches are placed medial to the cord to reinforce the triangular area and to close the ring snugly about the cord.

If a sac or a fat mass is found, the fascia of the external oblique is opened to the level of the internal ring and one makes a high ligation of the sac or the pedicle of the fat. Then the floor of the canal is strengthened with stitches under the cord. Finally the external oblique fascia is closed over the cord to restore normal relations. We use 35 gage, .0056 inch stainless steel wire for sutures.[7]

If the fat mass is quite small and the canal appears normal, one ligates the pedicle as high as one can reach through the external ring and does not open the canal. This same procedure is used for a congenital sac in a child.

The ideal result that we might offer the patient through hernia surgery would be "one hernia only per lifetime." How much routine

transpubic exposure will reduce the incidence of the second side hernia will be known only through experience. It will depend upon how many of these potential hernias actually exist at the time the patient comes with his first side hernia.

At present strangulated hernia causes more deaths in the United States than acute appendicitis.[8] Prompt repair of early hernias in the aged and infirm will reduce this mortality. Harkins[9] points out how much easier it is to repair an early hernia than a late neglected one. With modern anesthesia and early ambulation the surgical risk is less than the risk of strangulation.

SUMMARY

Inguinal hernia is basically a bilateral disorder. Many patients with a sound single repair will later develop a new hernia on the second side. A routine transpubic exposure will anticipate the second hernia in those cases in which it exists as an unexpanded sac or a mass of pedunculated fat in the canal.

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Dupuytren's Contracture

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FROM his earliest days at the Hotel Dieu in Paris, Dupuytren attracted attention by the originality and brilliance of his demonstrations, and not always to the credit of his chief, Pelletan. The story is told[49] that on one occasion Pelletan diagnosed a case as an inflamed ganglion, while Dupuytren stated it was a strangulated hernia. Pelletan, a little sarcastically, remarked that perhaps, then, Dupuytren's special skill was required for the surgery. Dupuytren operated and his diagnosis proved correct. With a solemn bow he handed his bistoury to the chief, who tried rather unsuccessfully to hide his discomfiture. Slowly Pelletan lost his pre-eminence and also his self-confidence. The climax[11] came in 1815 when Pelletan attempted to ligate the femoral artery in a case of false aneurysm with infiltration and morbid changes in the tissues. He succeeded only in tying up a section of the tissue, completely missing the artery. The patient died, Pelletan lost his position, and Dupuytren was appointed to take his place. It is said that on the first day of his new dignity Dupuytren, in full view of his colleagues, took off his hat to the Hotel Dieu and announced: "This position for which I have worked for twenty years is in the power of no man to take away from me. I am now chief surgeon of the Hotel Dieu." Lisfranc called him the "brigand of the Hotel Dieu." (Fig. 1.)

Although Dupuytren was the first[22] to demonstrate the pathology of the disease now called by his name and the first to describe it in detail in the literature, it was not completely unknown before his time. He himself discusses various theories which were prevalent as to its cause. In 1822 Sir Ashley Cooper[15] wrote briefly that contracture of the hand might be caused by contracture of the palmar fascia and advised that if the contracting bands were narrow they could be divided subcutaneously through a small incision. Although Cooper's procedure was used by a number of contemporary surgeons, the method is attributed to Adams[3] who used it frequently, dividing the bands subcutaneously at several points, including the upper and lower limits.

FIG. 1. Life size statue of Baron Guillaume Dupuytren (1777–1835) which stands today in the courtyard of the Hotel Dieu in Paris.

STATISTICS

Incidence. On the basis of over 600 cases compiled by various authors, Bunnell[12] estimates that Dupuytren's contracture develops in 1 to 2 per cent of the population. Skoog[64] points out that the character of the populations

used for studies of incidence is not always representative of the general population. However, he cites several studies made on groups of patients from general hospitals and infirmaries covering between 2,000 and 80,000 individuals each, in which the disease was found in 1.2 to 1.7 per cent of all patients. These studies would appear to corroborate Bunnell's estimates.

TABLE I
SEX INCIDENCE OF DUPUYTREN'S CONTRACTURE*

Authors	No. Cases	Male		Female	
		No.	%	No.	%
Keen	227	187	82	40	18
Anderson	39	25	64	14	36
Black	240	221	92	19	8
Byford	38	35	91	3	9
Kanavel, Koch and Mason	29	27	93	2	7
Davis and Finesilver	40	35	89	5	11
Gordon	51	46	90	5	10
Skoog	50	48	96	2	4
The New York Hospital	79	68	86	11	14
Totals	793	693	87	100	13

* From Davis and Finesilver,[20] with additions from The New York Hospital.

Sex Incidence. At first Dupuytren's contracture was noted only among men, but in 1881 Reeves[58] reported its occurrence among women. Data regarding sex incidence are given in Table 1.

Skoog in 1948 assembled the results of four studies made in institutions for old people and found that 85 per cent of the patients were men. In a second group of studies made on the incidence of the disease in families where inheritance was considered as a possible factor, 87 per cent of the patients were men. Therefore it can be assumed that about 85 per cent of all cases of Dupuytren's contracture occur among men.

Age Incidence. Keen[38] in 1882 reported several cases which he believed to be of congenital origin. Such reports have not come from recent authors, and Davis and Finesilver[20] questioned the accuracy of the diagnosis in the earlier reports. Several cases have been reported with onset from eleven to eighteen years of age. However, among seventy-nine cases at The New York Hospital there was one boy of fourteen, one patient who said she had had the disease since early childhood, and a third who reported that she had been operated upon for the first time when she was ten years old. The disease, then, may occur as early as the second decade of life.

However, studies made on widely different age groups record the greater incidence of the disease among older individuals. Skoog's assembly of statistics from the literature in relation to inmates of old people's institutions showed that 14.7 per cent of the men and 2.6 per cent of the women exhibited Dupuytren's contracture, percentages which are higher than the percentages of incidence in the total population. On the other hand, among the first one million men examined for induction into the Army of the United States during World War 1,[74] only five were rejected because of Dupuytren's contracture. These men were between the ages of twenty-one and thirty, with an average age of twenty-five. Davis and Finesilver found that the average age of patients in their series of cases was forty-two years. Table 11 concerns the age of patients at the time of treatment. In interpreting these tables it is well to recall the extension of longevity in recent years. The question of correct diagnosis in some of the early medical reports also must be considered. The figures lead to the conclusion that Dupuytren's contracture occurs predominantly in the older age groups. Its occurrence before the age of thirty is looked upon as exceptional.

TABLE II
DISTRIBUTION OF DUPUYTREN'S CONTRACTURE ACCORDING TO AGE GROUPS*

Age Decade	No. Cases
0–19	22
20–20	58
30–39	116
40–49	134
50–59	187
60–69	167
70–79	48
80–89	8

* From Skoog,[64] with additions from The New York Hospital.

Hands Involved. Dupuytren's contracture is bilateral in the majority of cases. When unilateral it occurs more frequently in the right hand. However, as Skoog has pointed out, statistics of bilaterality may be somewhat low since the disease rarely occurs in the two hands at the same time. Skoog also suggests that because of the relative inconvenience of right-handed crippling, such cases may come to treatment oftener than left-handed cases. It is

also noticeable that "handedness" is not generally reported in the literature, a fact that may to some degree alter the above suggestion, and should be considered in relation to the possible role of trauma in the etiology of the condition. Only 32 per cent of cases of unilateral Dupuytren's contracture occur in the left hand. (Table III.)

Fingers Involved. As Dupuytren noted in his classic monograph, the contracture occurs most commonly in the ring finger. The little finger is involved frequently. The thumb and index fingers are not commonly affected. Significance has been attached to these data in connection with the possible role of trauma in the etiology of the disease. While the ring finger is not the part of the hand subjected to repeated and continuous pressure in many occupations, it certainly is the area which bears most prolonged pressure in the handling of ordinary tools. Table IV lists statistics on the fingers involved, as noted by twenty-one authors from 1881 up to the present time.

Race Incidence. There is no very definite information on the racial incidence of Dupuytren's contracture. However, it has been rarely noted among Negroes or in the peoples of the Far East. Apparently it is a disease of the Caucasian race.

ETIOLOGY

Many theories as to the cause of Dupuytren's contracture have been advanced over the years. There are studies by competent observers to substantiate most of these theories. The problem remains controversial and unsolved. The condition is considered by some to be idiopathic. However, certain factors have been observed frequently in association with Dupuytren's contracture so that the relationship may signify more than coincidental concurrence. Some of these are considered briefly in this presentation.

Trauma. Cooper and Dupuytren both considered that the condition was caused by injury produced by constant use of the hands in work which involved pressure against the palm of the hand. Occasional cases have been reported in which single injuries were believed to have caused the condition. However, reports have been made which indicate that Dupuytren's contracture also occurs in those who do not work with their hands, and some observers report that it occurs more frequently in such individuals than in manual laborers. Davis and Finesilver (1932) tabulated reports from the literature covering 361 individuals and found that 46 per cent of the cases occurred among workers and 54 per cent occurred in those with sedentary occupations. The summary of literature presented by these authors supports the theory that work with the hands is not necessarily a factor in the causation of Dupuytren's contracture. Such data lose strength, however, since the percentages of workers and nonworkers who exhibit the condition have not been compared to the same percentages of the total population. Accurate statistical information on this point is not available since labor figures do not include substantial groups such as housewives or sportsmen.

Lund[47] studied the incidence of Dupuytren's contracture among 1,021 brewery workers, relating the study to age groups. Among the total number of workers he found an incidence of 8.1 per cent, with none in the age group

TABLE III
DUPUYTREN'S CONTRACTURE
HANDS INVOLVED*

Authors	No. Cases	Bilateral	Unilateral	
			Right	Left
Keen (1881)	184	103	58	23
Smith (1885)	70	43	22	5
Costilhes (1885)	79	55	14	10
Hedges (1896)	62	24	20	18
Anderson (1897)	39	24	10	5
Nichols (1899)	50	22	12	16
Janssen (1902)	16	9	4	3
Daeschler (1903)	15	12	3	...
Heuser (1904)	61	37	20	4
Black (1915)	240	104	89	47
Krogius (1921)	22	12	7	3
Byford (1921)	38	25	9	4
Kanavel et al. (1929)	29	17	4	8
Scholle (1930)	54	18	28	8
Davis, A. (1932)	31	18	7	6
Davis and Finesilver (1932)	40	26	8	6
Wagner (1932)	19	15	2	2
Schröder (1934)	30	17	7	6
Schnitzler (1935)	117	67	33	17
Maurer (1936)	200	107	52	41
Meyerding (1936)	273	175	69	29
Deckner (1938)	60	36	17	7
Lund (1941)	209	121	48	40
Horwitz (1942)	35	19	12	4
Einarsson (1946)	111	53	35	23
von Stapelmohr (1947)	26	17	6	3
Skoog (1948)	50	35	10	5
The New York Hospital (1952)	79	54	11	14
Totals	2239	1265 (56.4%)	617 (27.5%)	357 (16.1%)

* From Skoog,[84] with additions from The New York Hospital.

under thirty, and with a steady increase in incidence as the age advanced, ranging from 3.8 per cent between thirty and thirty-nine up to 25.3 per cent in the group over sixty. On the other hand, Herzog[31] compared the incidence of the disease in large groups of steel workers, miners and clerks, and concluded that the slight difference in figures did not indicate that Dupuytren's contracture was more likely to occur among manual laborers than among clerks. In Skoog's series of fifty patients thirty-three did manual work. The compilation of data in Table v (covering 4,868 individuals) with relation to the heaviness of their work indicates a definite relationship between the degrees of heaviness of manual work and the incidence of Dupuytren's contracture. Moorhead[53] expressed the opinion based on the examination of 142 cases that the disease is of unknown origin and not a traumatism.

Of seventy-nine patients observed at The New York Hospital, occupational records are available for seventy-three. Forty-eight of these, either because of work or avocations such as golf, baseball or gardening, unquestionably used their hands in ways which involved significant amounts of pressure on the palm of the hand. Among the others were housewives, who may or may not have done such work, and such others as undertakers, lunch-counter men and salesmen in whom the actual use of the hands is difficult to evaluate. In Table v these questionable cases are placed among those doing no manual or only light manual work, but it is possible that a fair proportion actually belong in the heavier work columns. In interpreting other studies on manual work in relation to Dupuytren's contracture it is well to consider the fact that avocations frequently are not reported, and that such groups as housewives occasionally are listed as doing *no* work with their hands.

From the foregoing studies it is evident that Dupuytren's contracture does occur in those who do not use their hands in steady manual work. It is evident, also, that many who do manual work do not contract the disease. However, there is significant evidence of distinct association between Dupuytren's contracture and manual work so that it is reason-

TABLE IV
DUPUYTREN'S CONTRACTURE*
FINGERS INVOLVED

Authors	Hands	Thumb	Index	Middle	Ring	Little
Keen (1881)	287	11	24	73	199	165
Smith (1885)	113	1	6	10	42	30
Costilhes (1885)	134	3	13	47	86	70
Anderson (1897)	63	4	3	22	39	28
Nichols (1899)	72	1	...	20	50	30
Krogius (1921)	34	3	1	12	31	27
Byford (1921)	63	4	1	10	35	18
Kanavel et al. (1929)	46	4	3	9	31	27
Scholle (1930)	72	1	5	10	42	28
Davis, A. (1932)	49	..	....	5	27	26
Davis and Finesilver (1932)	66	3	6	14	40	43
Wagner (1932)	34	..	2	10	27	27
Schröder (1934)	47	..	1	14	27	22
Meyerding (1936)	448	21	21	88	376	314
Maurer (1936)	307	..	11	97	172	130
Deckner (1938)	96	1	2	18	47	35
Horwitz (1942)	54	1	1	7	50	50
Einarsson (1946)	164	6	10	36	87	88
von Stapelmohr (1947)	43	..	2	10	23	24
Skoog (1948)	85	11	13	34	60	65
The New York Hospital	88	4	10	24	59	52
Totals	2,365	79	135	570	1,550	1,299

* From Skoog,[64] with additions from The New York Hospital.

able to assume that trauma is a contributing etiologic factor in a large proportion of cases.

Heredity. The role of heredity in the causation of Dupuytren's contracture is not clear. As Skoog pointed out, even when patients are especially requested to make inquiries concerning the occurrence of the disease in their families some of them fail to do so; others have no near relative who might throw light on the situation. The relatively late age at which most patients develop the disease also means that many who might have reported on earlier cases in the family no longer are available for questioning. Skoog knew of one family in which five of eight brothers had Dupuytren's contracture, and of a second family in which all three brothers had it. Several studies have been made in which occurrence in the family has been investigated as carefully as possible, and Krogius[44] published a particularly interesting family tree. There is some evidence, therefore, that lineage may be a causative factor in Dupuytren's contracture. There has been discussion as to whether the inheritance is dominant or recessive, with no convincing evidence available. The predominance of the disease among males has been considered as indication of a sex factor in the heritage. (Table VI.)

Concurrence with Other Collagen Diseases. As early as 1813 Chomel[14] noted that fingers could be contracted by "rheumatism" of fibrous tissues of the hand. From that time forward studies appeared, some of which led authors to conclude that there was a very definite connection between gout or rheumatism, arthritis and Dupuytren's contracture. Davis and Finesilver, however, noted only one case of arthritis among their forty cases, and Skoog, in a careful review of the literature, did not find that these diseases occur any oftener in association with Dupuytren's than would be accounted for by the fact that rheumatism and related diseases are prevalent among a large sector of the population of the age at which Dupuytren's contracture ordinarily is found. Bunnell, on the other hand, observed that patients who had Dupuytren's contracture tended also to have a tendency to limited joint movement which appeared to be due to hypertrophy, thickening and contracture of ligamentous tissue. Steinberg[67] classified Dupuytren's contracture as a form of primary fibrositis. Primary fibrositis as reported by Steinberg's

TABLE V

FREQUENCY OF DUPUYTREN'S CONTRACTURE IN RELATION TO MANUAL WORK*

Author	No. Cases	Light or No Manual Work			Heavy and Medium Manual Work			Very Heavy Manual Work		
		No. of Cases of D. C.	% Employees Doing Light Work	% of Cases	No. of Cases of D. C.	% of Employees Doing Medium Work	% of Cases	No. of Cases of D. C.	% of Employees Doing Very Heavy Work	% of Cases
Niederland (1933)	589	112	0.9	19	342	4.7	67.8	135	17.8	22.9
Schröder (1934)	2,198	350	1.4	11.8	1,700	6.3	77.3	148	8.8	6.7
Gerritzen (1936)	1,743	255	6.1	14.6	1,488	8.5	85.4	...	....	....
Vigdortschik (1938)	265	...	...	....	....	...	....	265	9.4	100
The New York Hospital (1942)	73	25	...	35.2	38	...	50.9	10	....	14.7
Totals	4,868	742	...	15.2	3,568	...	73.4	558	...	11.4

* From Skoog,[61] with additions from The New York Hospital.

study of the literature is associated with rheumatism in between 52 to 70 per cent of cases. At The New York Hospital we have found associated collagen diseases such as rheumatism, osteoarthritis, peritendinitis, subacromial bursitis and arteriosclerosis in thirty-two of our seventy-nine cases.

TABLE VI
FAMILIAL OCCURRENCE OF DUPUYTREN'S CONTRACTURE*

Authors	Cases	Incidence in Pedigree	Percentage in Pedigree
Keen (1881)	198	50	26
Costilhes (1885)	86	9	10
Hedges (1896)	60	3	5
Nichols (1899)	17	6	35
Janssen (1902)	16	0	0
McWilliams (1904)	24	2	9
Krogius (1921)	22	4	10
Kanavel et al. (1929)	29	8	28
Oehlecker (1930)	25	3	12
Wagner (1932)	19	0	0
Stackebrandt (1932)	17	5	29
Davis and Finesilver (1932)	40	5	12
Schröder (1934)	30	10	33
Maurer (1936)	200	12	6
Skoog (1948)	50	22	44
Gordon (1948)	51	4	8
The New York Hospital (1952)	79	5	6
Totals	963	148	15.5

* From Skoog,[84] with additions from The New York Hospital.

A number of authors from the earliest days reported single cases in which a condition similar to Dupuytren's contracture appeared in the foot as well as in the hand. Of twenty-nine cases Kanavel and his associates[87] found two cases of foot involvement and a third in which the cord-like structure suggested an early stage of the same condition. Meyerding reported four such cases in his series of 273 patients, and it is of interest that Lund, studying the incidence of Dupuytren's contracture in epileptics, found twenty-five cases of plantar involvement, all but three of which also had palmar contracture. Bunnell reported three cases of foot involvement among eighty-seven cases of Dupuytren's contracture. In all his cases the contracture was greatest on the medial side over the external plantar nerve which, he noted, corresponds to the ulnar nerve in the hand. His description is quite typical of the cases described throughout the literature; none of the symptoms were severe and pedal deformity was exceptional. Skoog, who made an especially careful search for the lesion, found ten cases of plantar involvement among fifty cases. At The New York Hospital we found three cases of involvement of the foot in a series of seventy-nine cases of Dupuytren's contracture. The author noted at the United States Veterans Hospital, Bronx, New York, one case in which both feet and both hands were affected. This patient also had Peyronie's disease.

TABLE VII
CONCURRENCE OF DUPUYTREN'S CONTRACTURE WITH VARIOUS COLLAGEN DISEASES

No. of Collected Cases of Dupuytren's Contracture	
524	of which 15 were concurrent with Peyronie's disease
547	of which 33 were concurrent with plantar aponeurosis
544	of which 156 were concurrent with rheumatism
491	of which 118 were concurrent with gout
165	of which 20 were concurrent with arthritis

Peyronie's disease (induratio penis plastica) was first reported by Kirby[41] in 1849. By 1906 thirteen cases had been reported, most of them associated with gout. Since this time a few cases of concurrence of Dupuytren's contracture and Peyronie's disease have appeared in the literature. There are, however, very few reports and it is difficult to tell whether the small amount of available data is due to lack of search for the phenomenon or to its relative infrequency. Table VII gives the incidence of Peyronie's disease as reported by several authors. In The New York Hospital one case was found among seventy-nine cases of Dupuytren's contracture. It is of interest, however, that although Skoog found no case of Peyronie's disease in his series of fifty cases of Dupuytren's contracture in a special study of epileptics in relation to Dupuytren's, he found seven cases of Peyronie's disease. Skoog reviews several authors who reported studies of Peyronie's disease in which from one patient to 10 per cent of all patients also had Dupuytren's contracture. While reports are still too meager to be conclusive, there is evidence of more than coincidental concurrence of Peyronie's disease and the lesion of the hand.

Epilepsy. There are two studies which suggest that there may be an abnormally high incidence of Dupuytren's contracture among epileptics. Lund (1941) found that the condition occurred approximately four times as often among epileptics as among factory

workers. In a series of 207 epileptics Skoog (1948) found that 42 per cent also suffered from Dupuytren's contracture and that there was also an abnormally high incidence of foot involvement and induratio penis plastica. The severity of Dupuytren's contracture increased with the duration of epilepsy, but he attributes this increase largely to the factor of increase in age rather than to the duration of the epilepsy.

Diabetes. Teschemaker[68] found a high coincidence between diabetes and Dupuytren's contracture. Davis (1932) found six cases of Dupuytren's contracture among 200 diabetics in one series, and seven among 640 in another. We have noted four cases of diabetes among our seventy-nine cases of Dupuytren's contracture at The New York Hospital.

Miscellaneous. Dupuytren's contracture has also been studied by various authors in relation to thyroid, parathyroid and pituitary deficiency; developmental deviation; contraction of the palmaris longus; focal infection; disappearance of fatty tissue in the hand; pressure from cervical rib; tuberculosis; and chronic intoxication, poisoning and various other conditions. There is no convincing evidence that these conditions and Dupuytren's contracture develop from a common etiologic source.

Nervous System. Eulenberg[25] reported a case of Dupuytren's contracture which he believed to be due to trophic disturbance following injury to the ulnar nerve. Abbe[1] noted an association of his cases with various "neuralgias" and nervous disturbances, and suggested that the disease was of nervous origin. Schubert[63] believed that Dupuytren's contracture might follow injury to the ulnar nerve, whether in the palm or not, and also might follow diseases of the central nervous system. However, he did not think that injury to the nerve would cause Dupuytren's contracture unless the patient was in some way constitutionally predisposed to the proliferation of connective tissue. Davis and Finesilver (1932) observed certain cases which corroborated this view. Another group of authors has found the condition in patients who showed signs of disturbance of the autonomic nervous system. Reichel[59] observed cases of Dupuytren's contracture in which there had been previous impairment of function in the region of the ulnar nerve. He believed that not only vasomotor but also purely trophic fibers are concerned. In several cases at The New York Hospital there have been injuries which might have affected the ulnar nerve. Dupuytren's contracture has also been noted in patients with syphilis of the central nervous system. There have been a fairly large number of reports associating the condition with varied disturbances of the nervous system. However, these cover so diverse a field that they are difficult to correlate. Experience with vast numbers of cases of causalgia, traumatic neuritis, and inflammatory and degenerative diseases of the central and peripheral nervous systems gives no evidence that Dupuytren's contracture is due to abnormal physiology of the nerve supply to the hand. Unfortunately, hospital records often are confused by the establishment of such diagnoses as "traumatic Dupuytren's contracture." It is important to point out that the clinical entity known as Dupuytren's contracture is an idiopathic fibrosis of the palmar fascia and not related at all to lacerations or other acute injuries to the soft tissues of the palm.

SYMPTOMS

The onset of Dupuytren's contracture usually is insidious and the lesion may be quite well established before the patient notices deformity, contracture or other symptoms. It may develop rather rapidly but gradual development appears to be the rule. Subjective symptoms such as pain, a dull ache, numbness, tingling or stiffness in the palm may precede the appearance of objective signs. In general, however, the first sign to be noted is a symptomless nodule in the distal transverse crease of the hand proximal to or just distal to it.

CLINICAL SIGNS

At first the skin is not adherent to this nodule, but fascial bands attached to the skin become thickened and contracted until they draw the overlying skin down into one or more dimples. As the disease progresses, dimpled areas become funnel-like depressions around which there are crescentic folds. From the area of the nodule thickened bands can be felt running proximally. If the fingers are extended, these cords stand out strongly and the skin between the cords becomes depressed. As the fascia becomes progressively thickened, these cords may extend as far proximally as the annular ligament of the wrist, or, distally, into the lateral or central portions of the digital

fascia. An effort to extend the fingers may indicate to the physician some limitation of movement before the patient is aware of the contraction. One to twenty years after onset the contraction appears, usually limiting the extension of the proximal interphalangeal joint of the ring finger first, and later the same joint of the adjacent fingers. The metacarpophalangeal joints may be involved later. The distal interphalangeal joints are hyperextended in cases of long duration. The lesion may vary in severity from a state causing only slight inconvenience to the patient to one so severe as to render the hand practically useless. As the process develops, subcutaneous fat disappears over affected regions. The skin in these areas becomes hard, indurated and adherent to the fibrosed fascia. Ischemia of the dimpled palmar skin is noted on forcible passive extension of the involved fingers. The fibrosis does not involve tendon sheaths. Digits flex fully from their position of limited extension. The condition may develop irregularly, stationary periods being alternated with progressive development of the disease.

DIAGNOSIS

The diagnosis of Dupuytren's contracture is not difficult. The signs of nodular thickening under the skin of the palm near the distal palmar crease, cutaneous dimpling at the same point and ischemia of the area on extension of the fingers are recognized readily by the clinician. Diseases affecting the tendon cause flexion of the distal interphalangeal joints. These joints characteristically are unaffected or hyperextended in Dupuytren's contracture. In spastic conditions the proximal interphalangeal joints usually are hyperextended while the distal interphalangeal joints are flexed, the reverse of the condition in Dupuytren's contracture.

ANATOMY AND PATHOLOGY

Some early authors attributed Dupuytren's contracture to pathologic changes in the tendons. Others, even after Cooper's and Dupuytren's demonstrations, considered that it was a disease of the skin. A few also confused it with spastic diseases. These views are of historical interest only, and the pathology of the contracture is recognized today as evident in the palmar aponeurosis and in the skin.

Anatomy. The palmar aponeurosis begins at about the distal margin of the transverse carpal ligament as an extension of the palmaris longus tendon. From this area it extends in a fan-like form, blending radialward with the thenar fascia and ulnarward with the hypothenar fascia, to end in slips to the four fingers and in some cases to the thumb. The slips on the proximal phalanges are also fan-like, dividing into medial volar, volar and ulnar slips. Longitudinal fibrous septa attach the aponeurosis to the skin, and between these septa run the terminal cutaneous vessels and nerves. This anatomic arrangement explains the clinical fact that marginal necrosis is more common following transverse incisions than when longitudinal incisions parallel to vessels and nerves are used. Over the distal part of the palm transverse fibers strengthen the aponeurosis on its deeper aspect. These transverse fibers attach to the metacarpals forming eight distinct compartments, in the four larger of which run the flexor tendons. In the four smaller ones are found the lumbrical muscles, the digital vessels and nerves. Two similar fibrous tissue septa bind the compartments in the mid-palm.

Pathology. Early descriptions of microscopic pathology were relatively few and were based usually on single cases or small numbers of cases. In 1904 McWilliams[48] reviewed the previous literature and concluded that the cause of Dupuytren's contracture was chronic hyperplastic inflammation which at first formed small tumors followed by scar tissue in the fascia, subcutaneous fat and adjacent connective tissue. Ikle,[34] on the basis of data in the literature and his own experience, considered that the relatively few observations of lymphocytic infiltration indicated that the disease was not inflammatory. He also found that the diffuse multifocal character of the process differentiated it from fibroma, and that the absence of local infiltration and of distant metastases as well as the paucity of mitotic figures in the microscopic studies showed it was not sarcoma.

The most extensive pathologic study to date is probably that of Meyerding[52] and his associates (1941). They reported the results of microscopic studies of sixty-one specimens removed operatively from fifty-seven patients. Previously Meyerding had observed the pathology of 448 hands of 273 patients. Meyerding considers that the disease probably originates in the interstitial connective tissue and usually

spreads to the skin and all palmar tissues down to the deeper structures but does not involve these deeper structures. In the subcutaneous tissue there is infiltration at first. Then, as the disease progresses, there is diminution or elimination of subcutaneous fat and an increase in connective tissue. Fibrous overgrowth gradually obliterates the capillaries. In the skin he found increase in the number of connective tissue fibers and increase in their density in the reticular and papillary zones of the corium, the areas chiefly affected. All layers of the epidermis showed marked proliferation and hypertrophy of fibrous tissue. In the fascia, however, Meyerding found no new capillaries or lymphatic infiltration such as occurred in the other structures. Describing the pathology of the aponeurosis, Meyerding wrote:

"The characteristic change is the proliferation of fibroblasts in the nodules of the contracture. These fibroblasts are round, oval, or spindle-shaped with pale staining nuclei and tend to grow in masses with their long axes parallel to one another. In very cellular areas where nuclei are closely packed many mitotic pictures may be seen. In this tissue all stages can be demonstrated from those just described to that in which the collagen fibers lie packed together so tightly that the thin, flattened nuclei can scarcely be distinguished; the fibers in such portions of the fascia are frequently hyalinized. The marked cellular proliferation is usually seen in the thickened areas of the fascia which corresponds to the base of the fingers in the palm. As new fibrous tissue is deposited and contracts, the fibrous connective tissue cells become mature, and flattened, forming streaks through the fascia . . .

"We have assumed that the cellular nature of the fascia described indicates the activity of the proliferative process; the degree of maturity of the connective tissue was graded on a basis of 1 to 4. The least mature process in which the tissue was very cellular was graded 1; the most mature, in which the nuclei were very small and very few when compared to the collagen fibers was graded 4."

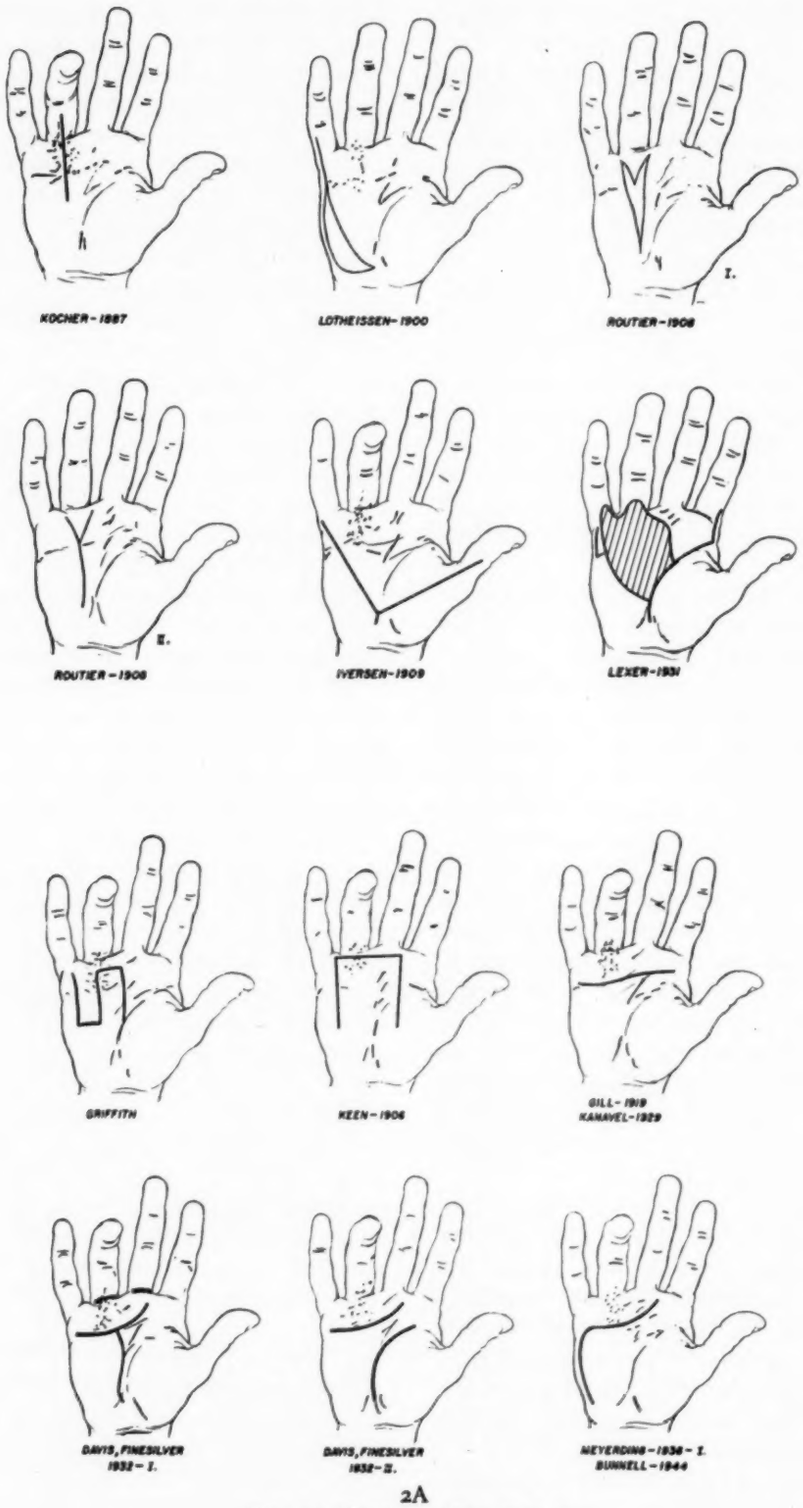
Meyerding found little relationship between the maturity of the connective tissue and the age of the patient. Although there was wide individual variation, there was a tendency of the tissue to be more mature in cases of long duration. Contraction, this author found, did not depend so much on maturity of the tissue as on the duration of the disease. In nine cases in which the condition recurred postoperatively the tissue was found to be relatively immature but without evidence of increased inflammatory activity. Meyerding considers that recurrence is relatively unlikely in patients operated upon at a stage when the tissue is mature and inactive. He found no evidence that Dupuytren's contracture is a neoplastic disease but considered it a "chronic inflammatory process." The inflammation, however, appears almost entirely in the skin, connective tissue and subcutaneous tissue, not in the fascia.

Skoog (1948) studied the palmar aponeurosis removed from twenty-nine patients during operation and from ten postmortem cases. He also studied (by the electron microscope) the fibrils from advanced pathologic lesions of nine operated cases and compared them with fibrils from unaffected areas. The fibrils from pathologic areas he found varied little in fundamental structure from the normal fibers. However, he found them significantly wider than the normal fibrils, and he noted that when breaks occurred in these wider fibrils the smaller ones were not always affected similarly. On the basis of these studies and experimental corroborative evidence, Skoog believes that stretching or some other process partially ruptures the palmar aponeurosis, which forms hypertrophic scar tissue in the process of repair. With the attendant shrinkage of the scarred areas, the disturbed balance between fibers of different areas and the decrease in normal nutrition of these areas there is greater probability of further rupture. Such ruptures, Skoog finds, are most likely to occur in areas of greatest strain, resulting in the cord-like forms extending below the fingers. Among his patients those with the most prominent cords either did heavy work or made special efforts to conquer the contraction by exercise.

SURGICAL TREATMENT

The localized nature of this disease classifies it at once as most readily corrected by surgery. Non-operative methods of treatment have been suggested, but search of the literature reveals no large series of cases so treated and reported later with critical investigation of the late results.

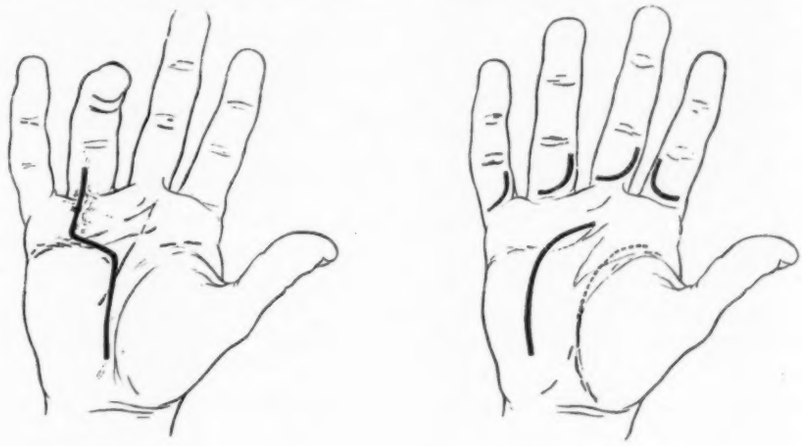
Trends in the surgery for this condition have varied from subcutaneous division of the



2A

FIG. 2A. For legend see page 111.

fibrous bands to limited excision of the regional disease and, finally, to complete extirpation of the entire palmar fascia. Subcutaneous division of the fibrous bands was practiced by Cooper (1822) and Adams[3] (1897). The obvious objection is that the fibrous bands cannot be divided first and second fingers later if necessary. Complete excision was first practiced at the turn of the century. Keen[39] and Iversen[35] removed all fascia from two patients in whom the disease process was so extensive that there was no alternative. Lexer[46] first practiced com-



2B

FIG. 2B. Hand incisions (2A and B) which have been popular in the treatment of Dupuytren's contracture. Lexer recognized the fact that the disease affects the circulation of the skin and did not hesitate to substitute a skin graft for devitalized areas of palmar skin. The incisions of Davis and Finesilver are very popular in the technic of total excision of palmar fascia. These incisions are very satisfactory if the disease has not invaded the subcutaneous fat and the dermis of the tissue between the two incisions. The diagram on the right (2B) was taken from Ashley. The solid curve incision allows for the limited excision of the diseased aponeurosis leading to the long, ring and little fingers. The author favors limited excision of the palmar fascia by this technic. If disease develops involving the thumb and index finger (dotted line), a second operation may be employed at a later date. The advantage of limited excision is that the probability of the serious complication of partial slough of palmar tissue is minimized greatly.

effectively through a puncture incision without danger of injury to the digital arteries and nerves which are involved intimately in the cicatrix. Convincing evidence that the method has lasting value is lacking. Limited excision, that is, the surgical removal of the area of fibrous tissue and of the palmar fascia in that area alone, was practiced by several surgeons in the latter part of the nineteenth century. This procedure is rather generally known as the operation of Kocher (1887),[43] who used it successfully on several cases. Although it has been used by many surgeons ever since, it has gradually been superceded by the more radical operation. Interest has recently been revived in this operation by Hamlin[29] who uses multiple incisions, and by Ashley[6] who removes palmar fascia and also the slips to the third, fourth and fifth fingers in one stage and operates upon the

plete excision as routine at the beginning of the twentieth century. This is the procedure advocated by Bunnell, Skoog and many other leading surgeons today.

The trend toward reactivation of the technic of limited excision is based upon the opinion that postoperative slough of the palmar skin is due to the dissection of large flaps of palmar cutaneous and subcutaneous tissue. That complication, truly to be abhorred because of the attendant manual and digital swelling with consequent irreversible ankylosis of interphalangeal joints, has not been shown to be due to the elevation of soft tissue flaps *per se*, and more properly is looked upon as due to the invasion of the dermis by the proliferative fibrous tissue process which destroys the dermal capillary bed as it produces ischemic dimpling of the skin. The cause of postoperative cu-

taneous necrosis is the disease process itself, the removal of which leaves only a layer of cornified epidermis at the joint of maximal contracture and dimpling. It is this local variation which must be recognized by the surgeon and treated promptly by excision of devascularized skin together with its replacement by skin graft or flap if necrosis with its severe attendant sequela is to be avoided.

The surgical attack on Dupuytren's contracture properly is the anatomic excision of the palmar fascia through all of the portion which is known to be subject to invasive fibrosis. This means that it is not necessary to locate the tendon of the palmaris longus, for the disease does not extend into that area. Nor is it necessary to develop flaps of skin and subcutaneous tissue so far laterally that all of the fascia overlying the thenar and hypothenar eminences are exposed. *However, the anatomic extensions of the fascia down into the intermetacarpal spaces around the digital nerves and down over the proximal phalanges must be removed if the patient is to be given protection against recurrence of the contracture.*

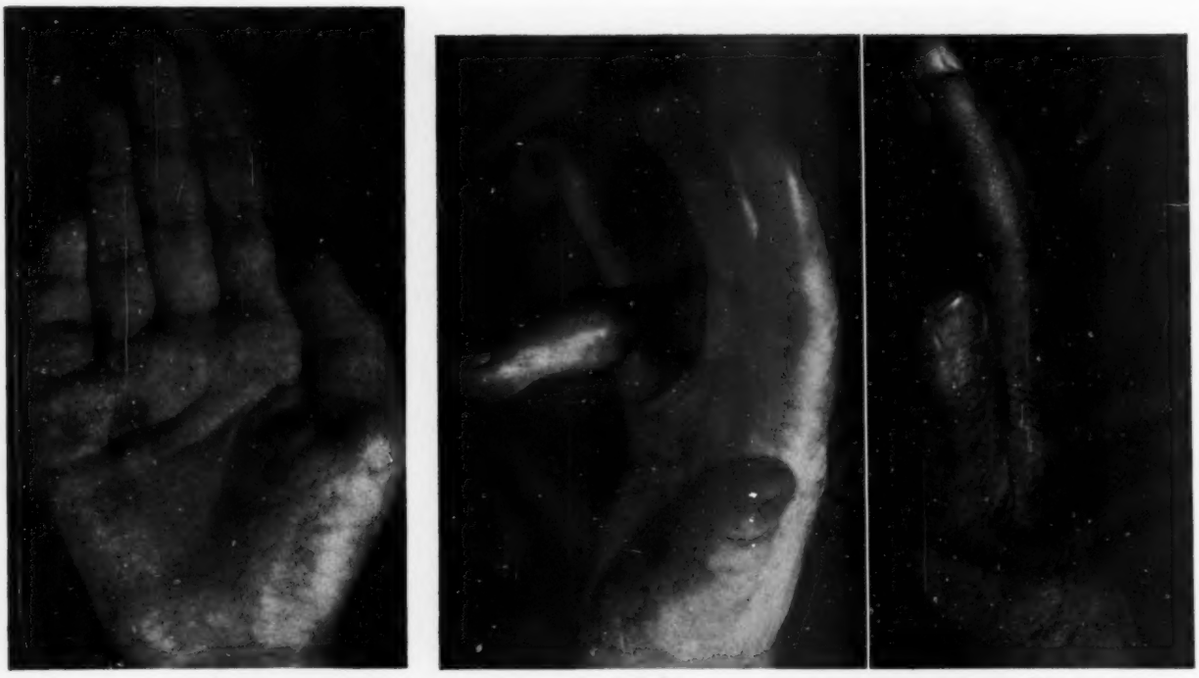
The palmar incisions which have been recommended for aponeurosectomy are myriad. These incisions have been planned either in bold design to expose and remove the aponeurosis with facility and without regard for the cutaneous flexion creases of the palm, or with insistence on the parallelization of incisions with those creases to the end that cutaneous healing will not be attended by cicatricial contracture. The author has used the incisions shown in Figure 2 along with minor variations. No one incision is recommended. The incision must be planned after close inspection of the deformity and should be executed in such a way that flaps are developed with palmar fat attached (if possible) to their undersurface. It is the author's experience that *palmar incisions not in line with cutaneous creases heal exceptionally well and with negligible scar unless there are complications of wound healing such as hematoma, infection or slough.* Experience furthermore teaches that *accessory digital incisions must be planned in L shape, the horizontal arm in the flexion crease and the vertical arm placed laterally, else there will be troublesome contracture of the digital operative scar.* The mere fact that such variety of incisions has been advocated attests to the complexity and variability of the problem. Emphasis must be placed on: (1) the excision of the diseased portion of the aponeurosis; (2) on the ready sacrifice of skin covering if deprived of its normally nutrient dermis; and (3) the replacement of that cutaneous defect by free skin graft or by flaps of skin and fat. Thin grafts of skin are not suitable for the palm. A thick-split graft of at least .016 to 0.20 inch in thickness is necessary in order to avoid the shrinking tendency of split grafts of skin. Whole-thickness grafts of skin often are preferred, especially for digital cutaneous defects. The most feared complications of palmar fasciectomy are hematoma under the flaps and necrosis of a portion of the flap or flaps. The former may deprive a physiologically balanced flap of its vascular nourishment, thus leading to the latter complication. Necrosis of a portion of the flap, only a *narrow* margin of it, may so derange the pathologic process of healing that persistent swelling of the soft tissues of the dorsum of the hand and of the digits promptly is in evidence. This condition is due to lymphedema, which promptly produces changes in the small joints followed by ankylosis due to periarticular and intra-articular fibrosis. Such a train of developments more often than not assigns the hand to a permanently crippling deformity. The avoidance of these serious complications of wound healing is the justification for the policy of limited excision of the palmar fascia as now practiced by the author. (Figs. 2 to 6.)

Preoperative Care. The affected extremity is shaved from the axilla distalward on the night before operation. It is then scrubbed with PhisoHex and wrapped in sterile dressings.

Operative Technic of Aponeurosectomy. General anesthesia is preferred although the operation can be carried out effectively under regional (brachial plexus) block by novocain. After cutaneous sterilization and application of sterile drapes the extremity is elevated and wrapped in an Esmarch bandage. This should be applied with dispatch and followed immediately by the application of a tourniquet above the elbow. If a pneumatic cuff is used for the tourniquet, this is outside the sterile field. A simple rubber belt type of tourniquet applied on top of a small towel wrapped about the arm is a most effective tourniquet and has the advantage that it is in the sterile field under control of the surgeon. The Esmarch bandage is unwrapped to expose the hand. After incisions are made, the flaps are reflected in all directions to expose the abnormal fibrous tissue.

FIG. 3. Patient W. M., New York Hospital Case No. 405387. Early nodular fibrosis of palmar fascia without contracture of digits which occurred in a forty year old manufacturer. Correction by limited excision of fibrotic palmar fascia (A, B). Possibility of further development of fibrosis in the residual palmar fascia is the single objection to the policy of limited excision. In this case the disease had been slowly progressive over a period of six years but there has been no recurrence (C, D) in the six-year period of postoperative follow-up.

The subcutaneous fat must be left attached to the *flaps*. Retraction and elevation of flaps is done by the use of small skin hooks in order to avoid crushing injury by thumb forceps. If the disease process has destroyed the fat layer and invaded the dermis, the surgeon must note this and consider the adequacy of circulation of the involved skin at the close of the procedure. The deeper dissection is best started at the point where the palmaris longus tendon inserts into the fascia. This is 3 to 4 cm. below the distal margin of the transverse carpal ligament. The aponeurosis is grasped with hemostats and painstakingly dissected away from the hand, care being taken to isolate the digital nerves, the deep volar arch and the digital arteries and veins. The septal extensions of the fascia down to the metacarpals are divided and the specimen is left attached distally near the level of the metacarpophalangeal joints. L-shaped incisions are made over the proximal phalanges of the fingers, and the digital extensions of the aponeurosis are freed from tendons and dissected proximally toward the palmar



4A 4B 4C

FIG. 4A to C. Patient A. C., New York Hospital Case No. 483579. A and B, Dupuytren's contracture with excessive nodular fibrosis which developed over a period of six years in an electrician sixty-one years of age. In this case complete palmar fasciectomy was carried out through the two incisions of Davis and Finesilver. The central palmar skin between the two incisions was markedly ischemic at the close of the procedure. It was sacrificed unhesitatingly and the area surfaced with a thick-split graft of skin. C and D, full manual function resulted and there has been no recurrence in the six-year follow-up period.

FIG. 4D. See above legend.

wound. By subcutaneous dissection the specimen is removed in one piece. In long-standing cases there may be complete fixation of one or more proximal interphalangeal joints in flexion. In such cases capsulotomy of these joints is carried out. Passive extension of such joints invariably leaves a cutaneous defect which must be compensated for by skin graft. The wound is now packed lightly with gauze compresses moistened with warm saline solution. A snug wrapper of gauze is applied and the tourniquet and the Esmarch bandage are removed. There need not be fear of peripheral nerve palsy due to tourniquet, even though it is left in place up to four hours, if the tourniquet has been properly applied, i.e., without undue irregular pressure over nerve trunks and without vascular engorgement of the arm. Reactive hyperemia following release of the tourniquet requires a waiting period of fifteen minutes before bleeding points are clamped and tied with No. 000 to No. 00000 plain catgut. *Absolute hemostasis is essenital.* The flaps are now inspected. *Any variation from normal coloration in areas of palmar skin deprived of sub-*

5A 5B

FIG. 5. Patient P. V., New York Hospital Case No. 643904. Dupuytren's contracture which developed over a period of two years in a thirty year old laborer (A). Complete palmar fasciectomy was done through the two incisions of Davis and Finesilver. Contracture of the little finger was treated by excision of fibrous tissue about flexion surface of finger, capsulotomy of the proximal i.p. joint and insertion of two elliptical thick-split (.020 inch) skin grafts (B).

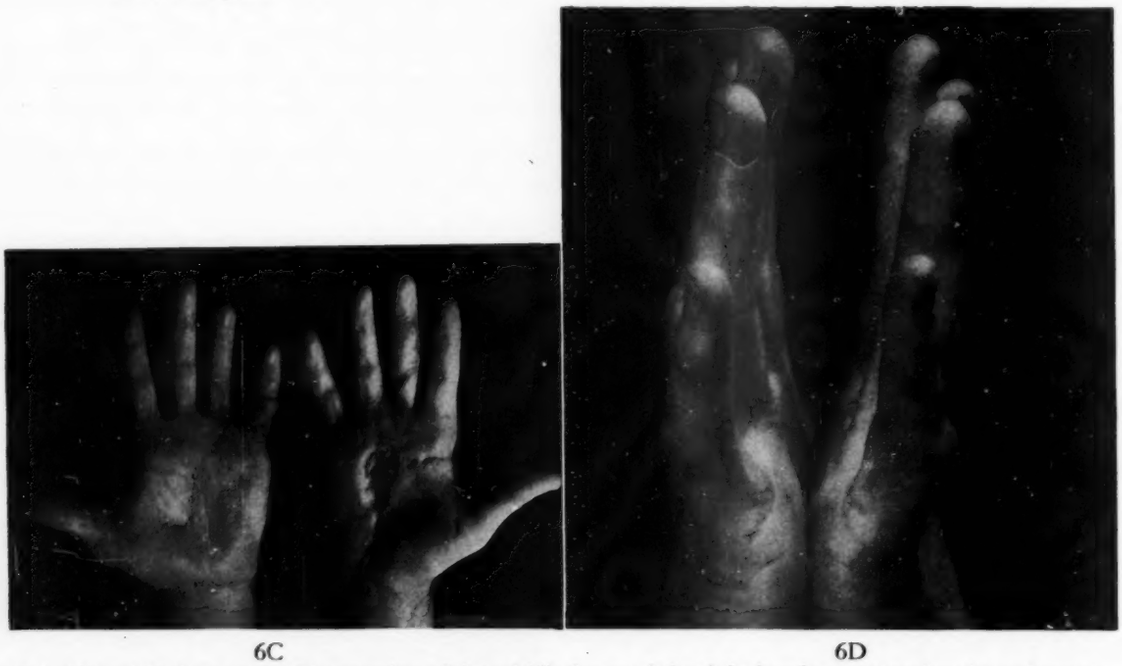
jacent fat requires close study for decision as to sacrifice of that portion of skin. If this situation does not obtain, the wound margins are closed by on-end mattress sutures of No. 000 silk. No drains are used. If incisions were made exactly in the furrows of flexor creases, the excision of a narrow marginal ellipse of skin facilitates the suture. The fingers are placed in the functional position of partial flexion, a bolus of cotton waste is put in the palm for pressure, and the forearm and hand are splinted with generous wrap-around dressings. Fingertips are left exposed. A dorsal forearm splint is applied.

If scarred skin is amputated, the defect is surfaced necessarily with a thick-split graft of skin (preferably .020 inch in thickness) fixed at its margin with sutures of No. 000 silk, the ends of which are left long in order to secure the graft by pressure over a bolus of cotton waste. A whole-thickness graft may be preferred. The antecubital fossa is a valuable source of such grafts since the area already is included in the operative field. In an occasional case an immediate flap of skin and subcutaneous tissue from the abdomen may be indicated by reason of exposed tendon sheaths. In such circumstances the flap is elevated from any area on the abdomen to which the hand may be fixed in comfort. Such an immediate flap must be broad-based. It is then rotated on its own base in hinge fashion so that the underside of the flap meets the open wound of the palm or finger. The donor defect and any open surface of the flap must be closed by suture or by graft. If this is not done, the development of granulation tissue in these areas may result in lymphedema of the hand. Suitable fixation of forearm to torso is accomplished by use of adhesive tape and/or elastic bandages.

Postoperative Care. Early authors advocated gradual forced extension of the fingers postoperatively. Various types of mechanical apparatus were developed for the purpose. The results were not very satisfactory and gradually they were used less and less except as adjuncts to other postoperative care. Bunnell advises only such splinting as is necessary to protect the wound during healing, and permits exercise of the middle and distal finger joints from the beginning, encouraging such exercise after the first week in the routine cases. A proper balance of immobilization adjusted to the needs of the individual case is the preferred procedure of surgeons of today, some using only such splinting as may be supplied by generous bandaging. After primary wound

6A 6B

FIG. 6A and B. Patient C. L., New York Hospital Case No. 211536. A and B, demonstrate the condition of this thirty year old physician's hand after two unsuccessful operations had been done on the left hand six years earlier (1941). The contracture of the little finger of the left hand was due not only to residual disease but also to postoperative fibrosis. In the operative extension of this digit it was necessary to expose the flexor tendons. This exposure demanded surfacing by pedicle tissue which was applied to the digit from the abdomen. Palmar fasciectomy on the right hand was followed by cadaveric ischemia of the palmar skin. This was excised and replaced with a thick-split (.020 inch) skin graft.



6C 6D

FIG. 6C and D. Same case. The scarring of the middle finger of the right hand was extensive throughout the skin. For this reason the flexor skin was replaced with pedicle tissue from the abdomen. Full function was restored by these procedures to both hands and the patient has been unencumbered in the six-year period of follow-up.

healing has been attained, some use is made of active or passive exercise, of warm water baths or whirlpool baths, of massage or x-ray. Splints are used during some parts of the day, or at night, to assist the extension of digital joints.

Two new adjunctive measures have been reported recently.

Vitamin E: Steinberg[67] found that patients with primary fibrositis suffered from a disturbance in the ability of the muscle to absorb vitamin E. On pathologic grounds he identified Dupuytren's contracture with primary fibrositis in which he was successfully using vitamin E therapy. Using an average dose of 300 mg.

of mixed natural tocopherols of which 60 per cent were alpha tocopherols, given in daily divided doses, he achieved clinical response in fibrositis in two to four weeks. Cure of Dupuytren's contracture of up to a year's duration was reported by him as early as four weeks after initiation of vitamin E therapy. In one case of thirty years' duration there was marked improvement in nine months although cure was not complete. It was found necessary to continue maintenance doses of vitamin E for several months after cure to prevent recurrence. King,[40] giving 100 mg. daily of tocopherol for three weeks followed by varying periods of maintenance doses, did not find the treatment successful. Kirk and Chieffi[42] reported on twenty-six hands with Dupuytren's contracture which were treated with dl-alpha tocopherol acetate daily for 300 days. Lessening of the degree of contracture was observed in twenty-three of the twenty-six hands although this improvement regressed somewhat 250 days after therapy was discontinued. At The New York Hospital vitamin E has been given in the form of alpha tocopherol to twelve patients postoperatively. Results have not been found sufficiently beneficial to warrant continuation of the therapy. In one case while alpha tocopherol was being given after operation for Dupuytren's contracture of one hand, the condition was observed to develop in the other hand.

Cortisone and ACTH: Baxter[8] reported a case with severe postoperative scarring and persistent contracture for which intermittent traction, vitamin E therapy and desoxycorticosterone with vitamin C had proved ineffective. Three and a half months after operation the patient was hospitalized and given 100 mg. daily of cortisone acetate, increasing the dose to 200 mg. the second week. Whirlpool baths and massage were started four days after the first administration of cortisone, and an elastic extension splint five days later. During the two weeks of administration of cortisone acetate extension of the little, middle and ring fingers was improved markedly. In later studies using five patients Baxter et al.[7] concluded that cortisone and ACTH by whatever route given had no effect on Dupuytren's contracture unless fasciectomy also was performed. While these authors considered their number of cases too small to give conclusive results, especially without control studies, they suggest that cortisone and ACTH may be useful in certain selected cases in which stiffness of the joints may be expected postoperatively. They also warn that the factor of delayed wound healing, which has been found to occur following use of these drugs, should be taken into consideration.

In The New York Hospital cortisone has been used postoperatively on four cases of Dupuytren's contracture. Results have not been encouraging. In one patient who had undergone palmar fasciectomy of one hand a coexistent Dupuytren's contracture of the other hand was seen to progress while the patient was being treated with ACTH. It would seem, however, that the limited use for cases in which digital stiffness is expected may be worthy of further investigation.

SUMMARY

Data are presented on the author's experience with seventy-nine cases of Dupuytren's contracture in comparison with a large number of cases taken from the literature. Limited excision of the diseased palmar fascia is favored by the author. Emphasis is placed on the importance of surgical judgment concerning the viability of palmar flaps. The gravity of the complication of even partial necrosis of a palmar flap is emphasized. When the circulation of a portion of a flap is in question, its ready sacrifice and replacement by free skin graft or pedicle tissue is advised. Accumulated data on the value of vitamin E and ACTH are reviewed and discussed.

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Efocaine for the Relief of Post-thoracotomy Pain

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IT is the surgeon's task to keep postoperative bronchial passages clear either by employing his mechanical aids or by using the patient's expulsive cough. The latter method is more constant, physiologic and practical, but at the same time is occasionally not the choice of the patient. Herein lies the function of a prolonged anesthetic agent for intercostal block.

The list of local anesthetics for the relief of pain and discomfort attending surgical incisions has recently been supplemented with a preparation called efocaine.® In view of its beneficial effects in a large series of anorectal operations[1] this pharmacologic agent was considered worthy of trial on patients subjected to thoracotomy for various reasons. As described herein, efocaine was used to produce intercostal nerve blocks in 100 such cases and the results evaluated in comparison with a previous series of 100 patients undergoing similar surgery without the use of this prolonged anesthesia for prevention of postoperative pain.

Pharmacologic Properties of Efocaine. Efocaine is a clear, non-oily solution exerting an anesthetic effect for a period of sixteen to fourteen days. The preparation consists of procaine, procaine hydrochloride, butyl-p-aminobenzoate, polyethylene glycol and propylene glycol preserved with sodium meta-bisulphate and phenyl-mercuric-borate. No vasoconstricting agent is present. Since the anesthetic components are dissolved in the organic solvent to the saturation point, contact with minimal quantities of tissue fluids causes precipitation of the anesthetics in crystalline form. The organic solvent is excreted within twenty-four hours, leaving the crystalline depot to maintain prolonged action.

TECHNIC OF ADMINISTRATION

Administration of efocaine during thoracotomy is simple and adds but seconds to the total operating time. The intercostal nerves are readily accessible, being either visible or palpable at the lower edge of the rib. The placement of ½ to 1 cc. of the solution into and about the nerve beneath the parietal pleura in the posterolateral chest gives intercostal analgesia for six to fourteen days. The nerve corresponding to the interspace or rib bed through which the operation was performed, as well as one nerve above and one nerve below, is similarly handled. A lock type of syringe is recommended in order to facilitate injection of the viscous solution and to prevent accidental spray of the pleura which might provoke chemical pleuritis.

The time of the nerve block during the course of the thoracotomy is important in that if the block is instituted on opening the pleural space the general anesthesia can be reduced in amount or depth for a considerable period of the operating time.

RESULTS

Incisions through the chest wall provide an excellent opportunity to evaluate the effectiveness of local anesthetics, not only because the accessibility of the intercostal nerves facilitates exact placement of the agent but also because the degree of pain associated with coughing may be ascertained by clinical observation and surface pin prick evaluation can be quite accurately made.

Heavy analgesic medication arrives at the same destination as cough repression, and the pulmonary complications are abundant if bronchial secretions, purulent material or blood are allowed to compromise full aeration of remaining lung tissue. Patients who experience considerable postoperative pain on coughing or who have a low pain threshold fear the consequences of bronchiolar or bronchial obstruction much less than the acute distress of a clearing cough. Since failure to cough following thoracotomy almost inevitably results in atelectasis

necessitating tracheal aspiration by catheterization or bronchoscopic aspiration, the effectiveness of intercostal anesthesia can be shown quantitatively by the relative incidence of aspirations among patients with and without prolonged efocaine nerve block.

TABLE 1

DEGREE OF POSTOPERATIVE PAIN AND INCIDENCE OF TRACHEAL ASPIRATION IN PATIENTS UNDERGOING THORACOTOMY WITH AND WITHOUT PROLONGED LOCAL ANESTHESIA

Anesthetic Agent	Total No. of Cases	Degree of Postoperative Pain			Incidence of Tracheal Aspirations	
		Minimal (No. Cases)	Moderate (No. Cases)	Severe (No. Cases)	No. Cases	Per cent
Efocaine	100	78	22	0	2	2
None.	100	0	30	70	30	30

The data for the two series of cases studied are presented in Table 1, together with an estimate of the degree of postoperative pain according to the patient's testimony.

SUMMARY AND CONCLUSIONS

1. Efocaine, a new preparation with anesthetic effects lasting six to fourteen days, was used to produce intercostal nerve blocks during thoracic operations in a series of 100 patients. Pharmacologic properties of this agent and the technic of administration are briefly described.

2. As shown by comparison with a control series of 100 patients undergoing thoracotomy without prolonged local anesthesia, efocaine reduced the degree of postoperative pain.

3. Since postoperative pain discourages coughing, which is necessary to keep the respiratory tract open, the incidence of atelectasis was much lower in patients receiving efocaine than in the control series.

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Simplified Intestinal Decompression Sound

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THE use of the long intestinal decompression tube as a method of decompressing the gastrointestinal tract has been universally recognized as one of the major factors responsible for a reduction in mortality rate in intestinal obstruction. Intestinal decompression is one of the most important features of treatment for intestinal distention regardless of the cause. In recent years attention has been called to the fact that many deaths occur because of the surgeon's inability to pass the intestinal decompression tube fast enough down into the lower reaches of the gastrointestinal tract. As a result strangulation of the bowel is all too common. This is especially apt to occur in the patient who is seen late in the course of intestinal obstruction after the distention has reached great proportions.

When the signs and symptoms of strangulation of the bowel are found upon examination of any patient, early surgical correction is imperative. In a case of this type sufficient time may not be available to permit the surgeon to pass the intestinal decompression tube down into the bowel. In this event, one is caught between the horns of a dilemma. If the surgeon elects to wait until the intestinal distention is corrected by the intestinal decompression tube, he may find gangrenous or perforated bowel when finally the abdomen is opened. On the other hand, if he elects to operate upon the patient as soon as shock, electrolyte imbalance and blood loss are corrected, then upon opening the abdomen he is confronted by a maze of markedly distended bowel. Often the bowel is so distended that manipulation without cracking the serosa is impossible and adequate exposure of the site of obstruction may be extremely difficult.

In those cases in which strangulation is suspected, operation as soon as possible is essential. This does not mean within one hour of admission to the hospital. It does mean within six hours of admission. During this interval of time a physical examination is done to determine the type of obstruction as well as its possible location. A survey film of the abdomen should be taken in all cases upon admission. Much valuable information can be gleaned from this one survey film. Electrolyte imbalance must be corrected and the patient adequately hydrated. If anemia is present, blood transfusions are given. An intestinal decompression tube is passed soon after the patient is admitted to the hospital, and a vigorous attempt is made to pass it as far down into the gastrointestinal tract as the allotted time before scheduled surgery will permit. Continuous suction is applied.

A survey film should be taken just before surgery to localize the position of the tube head. If the tube is found to have passed into the upper jejunum, or even if it is just beyond the ligament of Treitz, surgery should not be delayed. When the abdomen is opened in such cases, it is simple to thread the long intestinal decompression tube down to the cecum rapidly while applying continuous suction to its distal end.[1] By so doing, in a matter of ten minutes the entire gastrointestinal tract proximal to the point of obstruction can be readily decompressed. The tube thus renders the point of obstruction readily accessible so that surgical correction of the obstruction becomes a simple procedure. If the bowel is found to be necrotic and resection indicated, an empty decompressed bowel is far easier and far safer to anastomose than one distended and filled with intestinal contents. To assure rapid intestinal decompression in all such cases in which the tube head is found beyond the ligament of Treitz, it is sufficient merely to elevate the loop of bowel just proximal to the tube head. By so doing the highly labile, heavy mercury tube head rapidly runs downhill into the distended distal bowel. Continuous suction applied to the end of the tube assures rapid emptying of each loop of bowel so treated.

In those cases in which immediate surgery is indicated, however, and the tube head is still

in the stomach, needless delay in surgical intervention may be avoided by the use of a simplified intestinal decompression sound. Examination of Figure 1 shows this to be a sound 3 feet in length when fully assembled. The sound is 20 Fr. lumen. The end of the sound which is to be used as a suction tip is rounded and presents a lumen. (Fig. 2.) Just beyond the end of the tube three elliptically shaped holes arranged spirally around the tube are found. These permit rapid aspiration with a minimum of plugging by intestinal particulate matter. The tube is to be made in three 12-inch lengths joined to each other by being screwed one into the other. (Fig. 3.) Note in Figure 1 that the end of sound A screws into sound B at point 1. In the same fashion, sound B screws into sound C at point 2. When the sounds are disjointed, the suction is applied at points 1, 2 and the point marked suction on sound C. When the sounds are assembled into one 3-foot length, obviously only the end labelled suction is connected to the source of negative pressure. One inch below each end of each section of sound an elliptic hole is found. The function of this hole is to permit an intermittent break in the suction applied to the bowel when the sound is inserted. When suction is to be applied to the bowel, the index finger of the hand holding the sound covers this hole. By so doing the negative pressure will pass down the sound and readily aspirate the intestinal contents into the end hole and the spirally arranged elliptic holes. When the loop of bowel is being threaded onto the sound and suction is not desired for the moment, simply raising the finger covering this hole results in a loss of suctioning force. One such hole is found at the end of each section of the decompression sound to permit the use of each section as an independent unit.

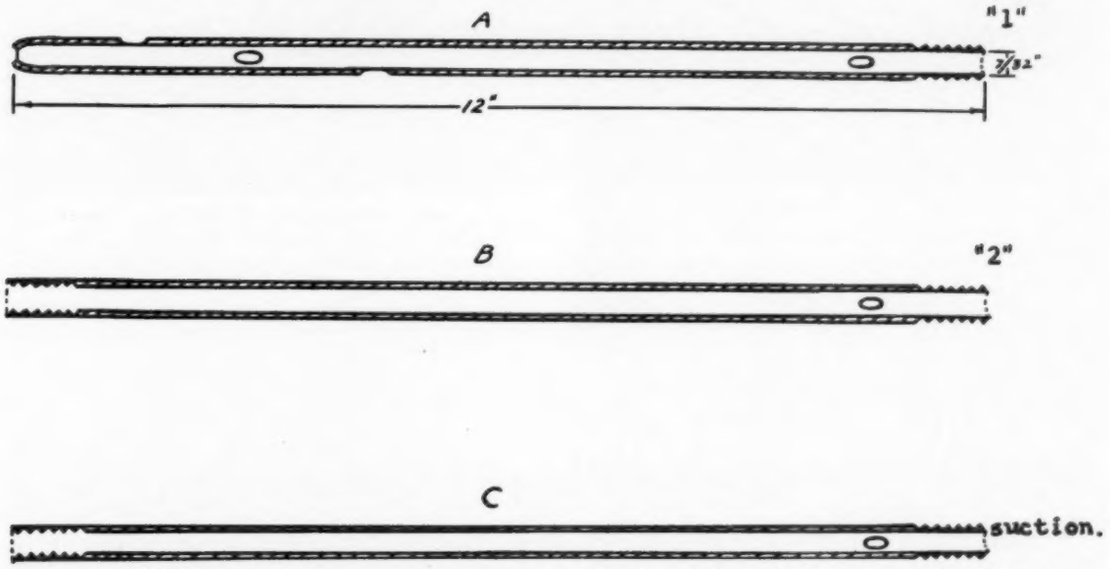

FIG. 1. Simplified intestinal decompression sound. Note the three independent sections A, B and C. These may be used as separate units or joined together into a 2 or a 3 foot long aspirating decompression sound. The 2 foot length can accommodate 10 to 12 feet of plicated bowel and is the length used most often. A 3 foot length of sound can accommodate 20 feet of plicated bowel, but the indications for its use will be rare.

A 3-foot long sound will permit 20 feet of small bowel to be threaded along its length. This has been amply demonstrated in the use of intestinal decompression tubes.[2] A strong suctioning force applied to the end of the tube will not cause mucosal necrosis unless it is of extremely high degree. In a great many cases treated by suction this has never occurred. Paine[3] demonstrated that even by using 1,000 cc. of water negative pressure that the mucosa was not injured. Any criticism that rapid intestinal decompression would result in mucosal demage is thus refuted not only experimentally by Paine but also on the numerous clinical occasions in which we successfully passed long intestinal tubes from the ligament of Treitz to the point of obstruction in the terminal ileum with the abdomen opened.

The technic of using the intestinal decompression sound is simple. When the abdomen is opened, the first loop of distended bowel is picked up. It is then well packed off by moist

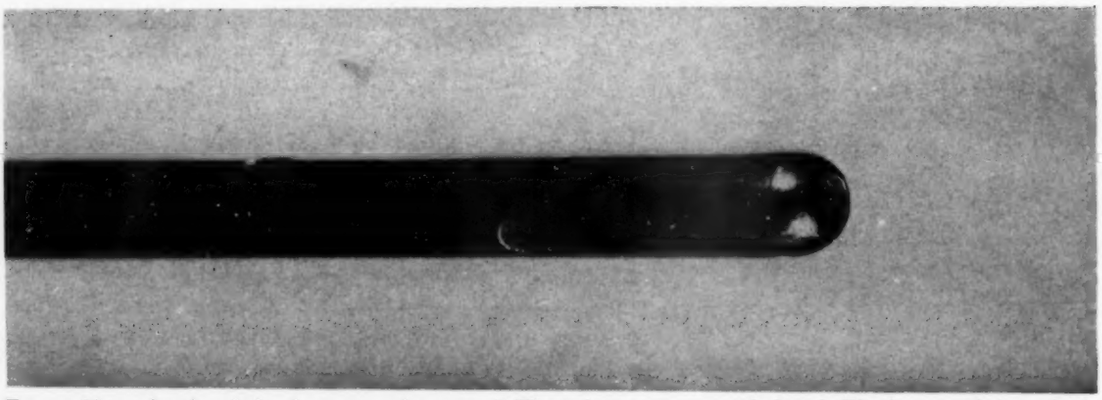

FIG. 2. Note the tip of the decompression sound. There is an open rounded end. The lumen of the tube is 20 Fr. The size of the holes is such that plugging by intestinal particulate matter is unlikely. There are three holes arranged in a spiral fashion around the tip of the sound in addition to the opening at the end of the sound.

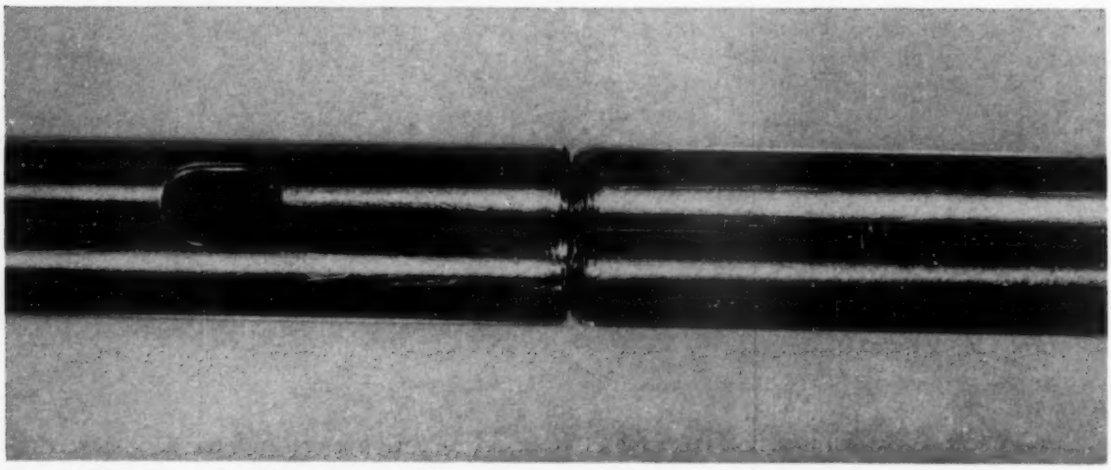

FIG. 3. Magnification of the joint between the sections of the decompression sound. Note the size of the hole to control the suction. This is magnified for purposes of illustration but its relative size is obvious.

warm lap towels. A purse-string of No. 000 chromic catgut is placed on its antimesenteric edge. A small opening is then made within this purse-string loop and the decompression sound A with continuous suction applied to its end at point 1 is rapidly inserted through the opening in the bowel into its lumen and the purse-string snugged. This prevents any leakage of intestinal content. The sound is then gently passed proximally along the loop of bowel. When this loop has been emptied, it is gently threaded onto the sound and continuous suction applied the next proximal segment of bowel. When sound A has been completely threaded with collapsed bowel, section B is screwed onto section A at point 1. While this is being done, suction is discontinued by merely elevating the finger from the hole at the end of the sound. After joining sounds A and B together the hole which was used as a break in the suction in section A is pushed into the lumen of the bowel where it acts as an aspirating hole. Similarly, the index finger is then placed upon the hole at the distal end of sound B just below point 2 when suction is desired, and elevated when suction is no longer required.

After the proximally distended bowel has been decompressed, the sound is slowly removed until only 1 inch beyond its tip remains within the lumen of the bowel. The direction of the sound is then reversed and the bowel distal to the loop selected for decompression is aspirated of its contents until the point of obstruction is reached. At this point the intestinal decompression sound has served its purpose. It is now removed and the purse-string tied. A second purse-string of No. 000 silk is then placed about the first. The col-

lapsed bowel may then be readily packed away from the site of obstruction which can be effectively dealt with.

By the use of this intestinal decompression sound the entire small bowel may be rapidly and effectively decompressed using only one small enterostomy opening which is securely closed by purse-string suture. With average care to prevent soiling, the danger of contamination of the peritoneal cavity is negligible. A liberal use of antibiotics postoperatively renders the procedure safe as well as effective.

The only possible difficulty is the occasional wound infection which may occur. A change of gloves and instruments before closing the abdomen and the proper draping of the wound with proper packing of the opened loop of bowel will obviate even this.

The following is an example of the type of case requiring the use of the intestinal decompression sound:

CASE REPORT

M. C., a twenty-nine year old woman, was admitted to Grace Hospital November 1, 1952, with a diagnosis of acute intestinal obstruction. She had been complaining of pain in the abdomen for five days. The pain was intermittent and severe. She had not moved her bowels for four days. Vomiting began two days prior to admission.

The patient gave a history of an appendectomy and uterine suspension seven years previously.

On examination she was found to be dehydrated and in obvious pain. Her abdomen was markedly distended. Marked tenderness to palpation could be noted over her entire abdomen but was especially marked over the lower right quadrant. Peristaltic activity diminished. Her temperature was 100°F., pulse 106 and respirations 28.

Laboratory studies were as follows: Blood: red blood cells, 3,620,000; hemoglobin, 12 gm.; white blood cells, 7,600; polymorphonuclears, 87 per cent; filaments, 77 per cent; non-filament, 10 per cent; lymphocytes, 11 per cent; eosinophils, 2 per cent; whole blood chlorides, 411 mg. per cent (70 mEq./L.); potassium, 17 mm. per cent (4.4 mEq./L.). Urine: specific gravity, 1.026; albumin, sugar and sedimentation, negative.

In radiologic study a survey film disclosed severe pathologic stasis in the entire small

FIG. 4. Note the marked intestinal distention of gas-filled loops in the upper part of the abdomen and fluid-filled loops in the lower abdomen.

intestine producing marked inflation in the upper half of the small bowel. Pronounced accumulation of fluid was noted in the lower half. One must consider the possibility of a low mechanical small bowel obstruction. (Fig. 4.)

The patient was given a 500 cc. blood transfusion and 1,000 cc. of 5 per cent glucose in saline shortly after admission. After the survey film was taken, a Cantor tube was passed and continuous suction started. The patient was prepared for surgery because of the presumptive diagnosis of strangulating acute intestinal obstruction. In the five-hour interval between the time of admission to the hospital and the time of surgery it was possible to do all the requisite laboratory and radiologic studies, pass an intestinal decompression tube, hydrate the patient and give a transfusion. The patient was taken to the operating room much improved. Just before being taken to surgery, however, a survey film was taken of the abdomen to determine the position of the tube head. At this time the tube was found to be coiled up in the stomach.

Under spinal anesthesia a right paramedian incision was made and the abdomen opened in layers. The bowel was found to be tremendously distended. The distention was so great that it was impossible to pack the bowel away

in an effort to expose the site of obstruction. A loop of distended bowel was picked up and packed off with warm lap towels. A purse-string suture was then inserted in the anti-mesenteric edge. An opening was made in the bowel at this point and the intestinal decompression sound inserted with continuous suction at its end. The sound was gently passed proximally and the bowel threaded onto the sound. By so doing it was easily possible to decompress rapidly about 10 feet of distended bowel. The sound was then reversed and the bowel distal to the enterostomy opening was decompressed. The sound was removed and the purse-string tied. A second purse-string suture of No. 000 silk was then inserted. The patient was placed in the Trendelenburg position and the collapsed bowel easily packed away from the site of obstruction. The obstruction was found to be caused by a 3-foot length of terminal ileum having forced its way through a hole in the right broad ligament. This rent in the right broad ligament had been permitted to remain after a Baldy-Webster suspension was performed. The broad ligament forming the roof of this rent was cut and the loop of bowel freed. It rapidly lost its cyanotic appearance and peristaltic activity became manifest. The abdomen was therefore closed tight with a small rubber drain just through the fascia.

The postoperative course was uneventful. The patient was discharged on November 8th, seven days postoperatively.

SUMMARY

A simplified intestinal decompression sound* is presented as an additional instrument for use in the treatment of intestinal obstruction. By its use it is hoped that the mortality rate of 15 per cent which is being generally reported can be reduced still further. This seems quite possible because now for the first time the surgeon has at his disposal a simple instrument permitting rapid intestinal decompression at the time of surgery. Needless delay necessitated by intestinal distention can now be avoided.

In the use of this instrument a note of caution is in order. Since the obstructed bowel is generally edematous and often friable, the bowel should gently be threaded along the sound *after* the distended bowel has first been collapsed by suction. In no case should the sound be pushed forcibly along the gastrointestinal tract. To do so is to invite perforation of the thinned out edematous bowel wall. In addition, the proximal bowel being threaded onto the sound must always be done under direct vision to avoid pushing the sound against the bowel wall too strongly.

The use of the decompression sound is not required in any case in which a survey film prior to surgery demonstrates that the long intestinal decompression tube head has passed beyond the ligament of Treitz. In cases of this type the intestinal decompression tube can be rapidly passed down the gastrointestinal tract decompressing it by the application of suction to the end of the tube.

In those cases in which the long intestinal decompression tube head will be found to be in the stomach, however, the use of the simplified intestinal decompression sound and its proper management may constitute a life-saving procedure because the instrument safely permits rapid intestinal decompression with the abdomen open. By so doing the point of obstruction and its cause can be well exposed after the collapsed bowel has been packed away. Surgical correction of the obstruction then becomes a simple procedure.

* Manufactured by the Clay-Adams Company, Inc., New York, N. Y.

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The Triad of Colostomy Care

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THE proper care of the colostomy has long been a subject of suggestions, articles and papers. This is simply an expression of the unsatisfactory answer for this problem. The fear of the average patient who is required to undergo an operative procedure which necessitates a colostomy as the end result of that procedure, is almost invariably the dread of the patient's social acceptability among his fellows.

It has been recognized for many years that adequate, complete cleansing of the colon at regular intervals will permit these patients to enjoy a comfortable life, free of embarrassment, and permit them to mingle with other people with complete confidence that no fecal accident will mar that association with others.

The triad of colostomy care is made up of three requisites: (1) consistency of the fecal stream; (2) control of peristalsis; and (3) complete or adequate cleansing of the large bowel. The first two portions of this triad are fairly easily solved. The diet of the colostomy patient should consist of simple, bland foods which in themselves do not promote hyperperistalsis, and the strict avoidance of any foods which promote hyperperistalsis or to which the patient exhibits any allergic tendencies. The dietary regimen as suggested by the Massachusetts General Hospital has proved to be a most satisfactory type of diet. The patient is started out on a limited diet to begin with which consists of boiled milk with cream of wheat and sugar, hard boiled eggs, dry toast, and a rather restricted amount of fluids for breakfast. Lunch consists of creamed soups, fish or meat with baked or mashed potatoes and boiled rice or custards. Dinner consists of meat or fish creamed and the avoidance of spinach or carrots in their vegetables. Later the diet may be liberalized and eventually the patients are able to determine for themselves what foods should be avoided in order to maintain a semi-solid satisfactory type of stool.

The second portion of the triad consists of the control of peristalsis or perhaps it may be better stated, the inhibition or slowing of peristalsis. The diminution of peristalsis and the avoidance of hyperperistalsis may be easily accomplished by the use of any of the anticholinergic drugs. I had long been impressed by the fact that patients on reducing diets who were given dextro-amphetamine sulfate or racemic amphetamine sulfate consistently complained of constipation. These drugs abolish or diminish hunger by their antiperistaltic action which also results in constipation in these patients. It impressed me that this constipating action which is an undesirable side effect in the weight reduction patient should prove to be a most desirable type of primary effect in the colostomy patient. It also occurred to me that in order to avoid the appetite suppressing effect of the drug, one could give it after meals, and thereby produce the constipating action as a primary effect without the anorexia. This proved to be the case, and I found that the bowel movements of these patients were satisfactorily controlled. A further desirable effect of the drug was the sense of alertness and well-being these patients noted while taking the drug.

With two of the three requisites accomplished, there remained only the satisfactory cleansing of the large bowel to make the triad complete. I have read for a number of years the papers and articles dealing with the satisfactory cleansing of the bowel and noted that all these devices had as their objective the preventing of the soiling of the patient during the period of administering the enema. If one is to accomplish complete cleansing of the bowel, it is necessary for this cleansing effect to reach back to and include the cecum. This is an impossibility unless a closed system is maintained while administering the enema. While watching one of my urology colleagues inserting a hemostatic bag catheter called the Foley catheter, it occurred to me that this should be an ideal type of instrument to use in

the administration of the enema. Subsequent testing has proved the thought to be correct.

The patient inserts a No. 24 Foley catheter with a 30 cc. bag through the colostomy stoma and then injects 30 cc. of air through the tube leading to the bag, using an ordinary long-tipped Asepto syringe. The tube is clamped with the fingers, the syringe is removed and an ordinary wood golf tee is inserted to prevent the loss of air in the bag. The patient is then ready to administer the enema. The tip of the tubing leading from the enema container is fitted with a glass tube which is inserted into the catheter portion of the Foley catheter. Slight backward pull is made on the Foley catheter which effectually brings the bag against the posterior part of the abdominal wall and the enema may be administered without the slightest suggestion of leakage. After the administration of the enema the tube is held with the fingers and the enema tip removed. The patient either bends over the toilet bowl or holds a basin under the stoma. The air is allowed to escape from the bag of the catheter by removing the wood golf tee and the catheter is then drawn from the stoma. The colonic content is allowed to escape. There is no unpleasantness or soilage and I have been impressed by the fact that these patients have been most happy and contented under this regimen. I find that most of my patients are able to cleanse the bowel in this manner, once in forty-eight hours as long as they watch their diet and use the amphetamine sulfate.

X-RAY therapy for cancer of the cervix uteri occasionally produces serious gastrointestinal complications. Some patients have clinical evidence of injury to the rectosigmoid and these patients have bloody stools, diarrhea and tenesmus. When the ileum is damaged, signs of small bowel obstruction may be present. X-rays can produce ulcers of the mucosa, resulting in perforation, peritonitis and death. Moreover, these mucosal ulcers heal slowly with excessive scar tissue and adhesions, often causing intestinal stenosis and obstruction. (*Richard A. Leonardo, M.D.*)

Primary Carcinoma of the Ureter Associated with Primary Carcinoma of the Colon

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A REVIEW of the world literature up to January, 1953, has revealed 312 cases of primary carcinoma of the ureter. None of the previously reported cases that we could find were associated with another primary malignancy. We wish to report a case of primary carcinoma of the ureter that was found five months following a partial colectomy for primary carcinoma of the ascending colon.

CASE REPORT

A fifty-five year old white woman was seen in December, 1951, with a six months' history of rectal bleeding. Barium enema revealed a carcinoma of the ascending colon. Past history revealed that the patient had had a hysterectomy in 1936 for menorrhagia. The urine was negative, except for an occasional white cell. At surgery a large carcinoma of the ascending colon was found and a right colectomy was performed, with anastomosis of the ileum to the transverse colon. During exploration of the abdominal contents both kidneys were normal without evidence of any enlargement. Postoperative recovery was uneventful.

The patient was well until five months after surgery when she had an acute onset of pain in the left costovertebral angle which radiated to the left groin. There was no frequency, nocturia, dysuria or incontinence. Careful questioning revealed that two months previously she had noticed some blood in her urine on two occasions. The pain in the left costovertebral angle gradually subsided in a few days. Examination revealed some tenderness in the left costovertebral area and a questionable mass in the left upper quadrant. The urine was negative. Non-protein nitrogen was 24 mg. per cent. Chest plate was negative. An intravenous pyelogram revealed no function in the left kidney and normal findings on the right.

FIG. 1. Retrograde left ureterogram. The large hydronephrotic left kidney shadow is seen. The large filling defect is seen in the lower third of the left ureter and also the hydro-ureter above the obstructing carcinoma.

Cystoscopy was performed and it was not possible to catheterize the left ureter beyond 3 cm. Injection of contrast medium into the ureteral orifice revealed a filling defect of the lower third of the left ureter. Dye was injected beyond the tumor revealing a hydronephrosis. (Fig. 1.) A diagnosis of primary carcinoma of the left ureter was made. The possibility of a

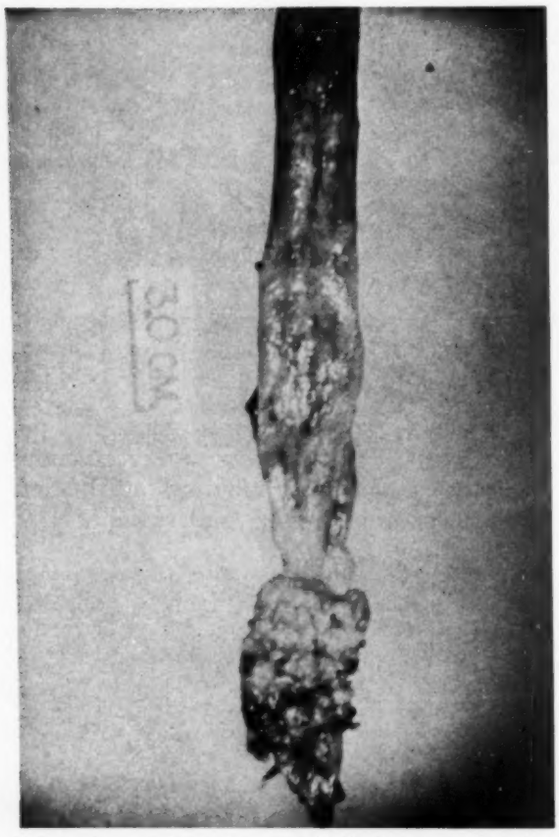

FIG. 2. Surgical specimen of the left ureter opened to show the papillary carcinoma of the ureter extending for 4 cm. in the ureter, beginning 2 cm. from the ureterovesical junction.

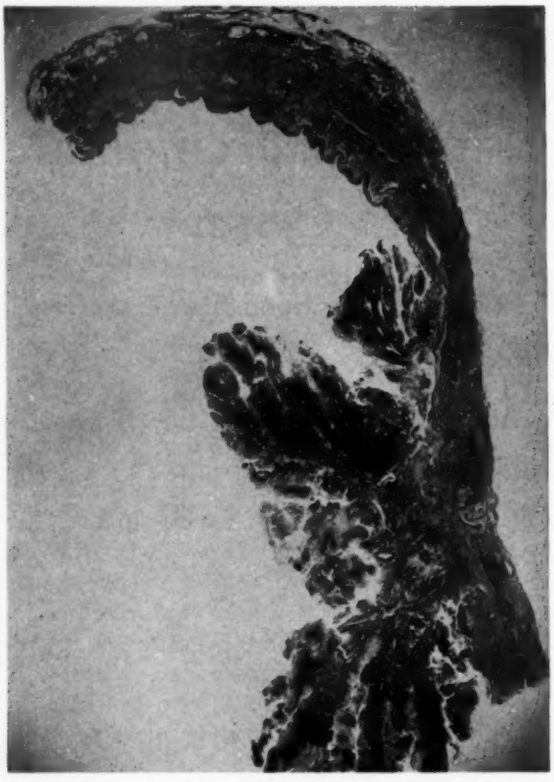

FIG. 3. Microscopic specimen of the projecting papillary carcinoma arising from a broad-based stalk in the ureter; the carcinomatous cells have invaded the muscles of the ureter.

metastatic lesion from the colon or an old stricture was also entertained. The latter seemed unlikely in view of the negative renal findings during the abdominal operation five months previously. At surgery a large hydronephrotic kidney with chronic pyelonephritis was found. A complete ureteronephrectomy was performed including the removal of a cuff of bladder around the ureteral orifice. When the lower third of the left ureter was opened, there was a large papillomatous carcinoma which projected into the lumen of the ureter causing complete obstruction. The tumor extended to within 2 cm. of the ureterovesical orifice. (Fig. 2.) The pathologic diagnosis was papillary carcinoma, transitional cell type. (Figs. 3 and 4.)

The patient made an uneventful recovery and is doing well up to the present time.

COMMENTS

The association of two primary malignancies in different organs of the body is not uncommon. Hanlon reviewed 3,000 consecutive necropsies and found that 2.5 per cent had multiple neoplasms. Warren and Gates, in 1,708 autopsies, found that 3.7 per cent had multiple neoplasms. Slaughter, in a statistical review of 1,868 cases, found an incidence of 3.9 per cent of multiple malignancies. Reported cases of multiple neoplasm will probably increase because of the increasing age of the general population, and our increased knowledge of the management of neoplastic disease. Also, an individual with one malignancy is more prone to the development of another malignancy than is an individual who has never had a malignancy.

Symptoms due to a second malignancy may simulate symptoms due to metastases or local spread of the first malignancy. All diagnostic methods should be used to rule out the presence of an associated neoplastic disease. In the present case intra-abdominal metastases of the colon carcinoma with obstruction of the left ureter could explain the x-ray findings of hydronephrosis. The absence of bowel symp-

toms and the clear-cut picture of an intraluminal ureteral obstruction pointed to another primary tumor.

Primary carcinoma of the ureter was first reported in 1841 by Rayer, and Albarran was the first to diagnose the condition preoperatively in 1902. Rousselot and Lamon found fifty cases in the literature in a report in 1930 and Lazarus and Marks made an exhaustive review of 183 cases in 1945. Since that time 124 cases have been reported including the present case.

Malignant tumors of the ureter occur most frequently in the sixth and seventh decades of life; the youngest patient in the literature being twenty-two and the oldest eighty-nine. Campbell states that malignant epithelial tumors of the ureter have not been reported in children. Scott in a review of 182 cases in 1943 found that 66.3 per cent of patients were males. The right ureter was involved in 67 per cent of cases and the lower end of the ureter was involved in 52 per cent. Nothing is known concerning the etiology of these tumors.

Pathologically the tumors of the ureter arise from the transitional cell epithelium of the ureteral wall. The great majority of these tumors are transitional cell carcinomas which may take the form of a papillary carcinoma. There have been some cases of squamous cell carcinoma of the ureter which have usually been associated with chronic infection or malignancy in the renal pelvis or kidney parenchyma. Loef and Casella have reported a case of squamous cell carcinoma occurring in the stump of a chronically infected ureter many years after nephrectomy and show how a metaplastic process can change the nature of a cell in the course of time from benign to malignant by irritation due to the presence of chronically infected tissue. Malignant tumors of the entire transitional cell epithelium of the urinary tract are similar grossly and microscopically.

Hematuria is the outstanding symptom and is present in 70 per cent of cases. Pain due to ureteral obstruction or metastasis is present in 64 per cent of cases. A palpable abdominal tumor, usually due to an enlarged kidney, the ureteral tumor or enlarged lymph nodes, is present in 40 per cent. The symptoms of ureteral neoplasm are not diagnostic *per se* but point to the need of complete urologic investigation. The patient may have many symptoms pointing to a malignant process in

FIG. 4. Low power view of the transitional cell carcinoma of the ureter; invasive edge. Tumor moderately anaplastic, mitotic figure in left upper corner.

the body such as weight loss, anemia, malaise, poor appetite and fever and have no urinary symptoms. Examination of the urine will almost always reveal the presence of red cells. Many patients will have white cells and bacteria in the urine indicating an infection behind a ureteral obstruction.

Excretory urography usually shows no function on the involved side since most tumors are seen after long-term obstruction with the resultant hydronephrosis and impaired renal function. An early tumor may show a negative filling defect in the ureter with a mild hydronephrosis above it. Some ureteral tumors that have been associated with long-standing hydronephrosis may have infection with calculi in the kidney or ureter. Lesions of the ureter by excretory urography are easy to miss because of the tendency for incomplete visualization of the ureter. The diagnosis is usually made by cystoscopy and retrograde urography. At cystoscopy blood or tumor may be seen coming from the involved ureteral orifice. There will almost always be obstruction to the passage of a ureteral catheter up the ureter. The characteristic picture on retrograde urography is a

negative filling defect in the ureter. The dye may only show the lower margin of the ureter, or it may be able to demonstrate the entire tumor with dilated ureter above it as in the present case. The filling defect of the ureter must be differentiated from stricture of the ureter, non-opaque stones, granulomatous lesions and ureteritis cystica. In the present case stricture of the ureter secondary to a previous pelvic operation was a serious consideration.

The treatment of carcinoma of the ureter is complete nephroureterectomy usually done in one stage. Many surgeons remove a cuff of the bladder if the tumor is close to the ureteral orifice. X-ray and radium therapy have no place in the treatment of these tumors.

The vascular and lymphatic supply of the ureter is abundant and metastasis to the liver, bones, lung and regional lymph nodes is common. Metastases have been seen in 62 per cent of cases. The prognosis of these tumors is very poor.

SUMMARY

A case of primary carcinoma of the ureter associated with a primary carcinoma of the colon is presented. The association of two primary malignancies in different organs of the body is not uncommon and the value of exhaustive diagnostic studies in such cases have been emphasized. The literature of primary carcinoma of the ureter has been reviewed.

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Endometrioma of the Sigmoid with Vicarious Menstruation and Intermittent Intestinal Obstruction

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THE first recognized instance of obstruction of the large bowel secondary to an endometrioma was reported in 1909 by Meyer.[1] Since that time there have been countless reports of endometriosis involving the colon and a number of reviews of the subject.[2–9] In patients presenting obstruction and bleeding from lesions of the left colon, the primary concern is the establishment of the correct diagnosis so that proper therapy may be instituted. The purpose of this report is to present a case of endometriosis of the sigmoid with subacute and intermittent intestinal obstruction associated with vicarious menstruation.

An endometrioma is a localized area of endometrium-like tissue bearing characteristic glands, stroma and occasionally smooth muscle, and thriving in an unnatural site. When such lesions are diffuse or multiple, the designation of endometriosis is given; the terms, however, are used interchangeably.

From a diagnostic standpoint the cyclic and progressive recurrence of the symptoms and signs which are induced by the physiologic menstrual-like changes occurring in this aberrant tissue are almost pathognomonic. Many theories have been propounded to explain the origin of an endometrioma. The most generally accepted is Sampson's,[15] who postulates that endometrium shed from the uterine canal at the time of the menstrual period is forced in a retrograde fashion, or direction, through the fallopian tubes and becomes implanted on the peritoneum. Other theories are metaplasia of cells, activation of fetal rests, and lymphatic or venous metastasis.

Involvement of the large bowel by an endometrioma is not uncommon and with few exceptions the chief intestinal involvement is limited to the serosa of the rectum and sigmoid portions of the colon. There is a wide variation in the literature as to the incidence of such involvement. Keene[5] reports an incidence of 5 per cent as contrasted to that of Jenkinson,[4] who found such lesions in 40 per cent of cases. Intestinal obstruction, when noted, may be either partial or complete and usually results from constriction and puckering of scar tissue with kinking of the bowel; or occasionally the effects of ulceration, hyperplasia of the endometrium in the bowel wall and edema. Cattell[9] found intestinal symptoms were present in 16.3 per cent of a series of cases reported by him. Others estimate that some degree of intestinal obstruction exists in 30 to 40 per cent of patients who undergo surgical treatment for endometriosis of the bowel. However, reports available in the literature indicate that endometriosis of the colon very rarely progresses to the point of producing gross rectal menstruation.

DIAGNOSIS

Symptoms of endometriosis of the sigmoid have been extensively reviewed by Mayo and Miller.[16] These occur generally in an otherwise healthy individual in the active years of menstruation, although cases have been reported which were first recognized after the climacteric. Progressive acquired dysmenorrhea associated with other menstrual irregularities is most suggestive of the lesion. Sterility following one successful pregnancy is a frequent complaint. Pain on defecation with increased constipation, associated with the menstrual flow, and on rare occasions the presence of gross blood in the stools may be described. Sigmoidoscopic examination may be limited by pain and fixation of the tissues, making it impossible to approach such lesions adequately well for biopsy purposes. Barium enema may

reveal a filling defect which may or may not have a normal mucosal pattern. Accentuation of all presenting symptoms at the time of the menstrual flow is the most constant diagnostic feature. Physical examination may reveal tenderness in one or both adnexal regions with variable amounts of fixation of the pelvic structures. The presence of nodules in the rectovaginal septum is helpful. A preoperative diagnosis, however, of endometrioma of the sigmoid or upper rectum is seldom made.

TREATMENT

This condition, in the most part, regresses spontaneously at the time of the menopause or may be induced therapeutically. Endometrioma of the sigmoid is most often found incidentally during a laparotomy for pelvic endometriosis, with which it is so commonly associated. All discreet endometriomas of the bowel may be eradicated by cautery or may be resected when sterilization is not carried out. In the larger endometriomas of the sigmoid, the majority of the reported cases have been treated, particularly those producing obstruction, by resection and end-to-end anastomosis. In most instances this is carried out after diversion of the fecal stream by colostomy. There are, however, a number of reported cases of recession of large sigmoidal endometriomas following castration alone or colostomy and castration in cases with obstruction. Cattell,[9] Miles,[10] McKittrick,[11] Pemberton[12] and others have had cases with severe sigmoidal involvement which appeared to regress with castration. This was the experience in the case which we are reporting. Some individuals recommend irradiation castration but possible objections to this method include the uncertainty of permanent sterilization, possible activation of a dormant pelvic inflammatory disease and, most important, the inability to exclude the presence of carcinoma. Dockerty[14] has summarized the treatment of obstructing endometriomas of the colon by recommending employment of radical procedures on the endometrioma in young women where possible, and surgical intervention on the gonads for older women.

CASE REPORT

This patient, a twenty-four year old white female, was first seen by us on September 9, 1952, stating she had had pain in the right lower quadrant of the abdomen for approximately two years. In addition it was noted that menstruation regularly was accompanied by gross rectal bleeding and that her bowels failed to move for a period of three to four days during each menstrual period. There had been periodic vaginal metrorrhagia. The patient had had one child but had been unable to conceive subsequently. She complained of severe and progressive dysmenorrhea. Physical examination revealed a lower abdominal scar which was well healed and through which the patient had had previous pelvic surgery carried out elsewhere. There was a mass in the right adnexal region. The uterus was fixed to the left side of the pelvis. No irregularity could be felt in the rectovaginal septum. The remainder of the examination was essentially negative. Proctosigmoidoscopic examination was performed on September 10th. It was impossible to pass the instrument beyond the 18 cm level because of the fixation of the bowel and discomfort to the patient. Bleeding was seen but no evidence of intraluminal pathologic disorder was noted. Roentgen examination, using the barium enema and air contrast studies, revealed the presence of an obstructing lesion in the sigmoid colon. (Figs. 1 and 2.) The lesion was located in the mid-sigmoid or proximal sigmoidal segment and was characterized by a rather long, 3 inch segment, of narrowing with irregularity and loss of the mucosal markings. This constant defect was well demonstrated on numerous views, and it was noted that the adjacent margins of the bowel did not appear undermined or overhanging but rather merged into normal-appearing intestine in a rather fusiform manner. The left colon, proximal to the lesion, was definitely enlarged and dilated, and contained rather large amounts of retained fecal material resulting in mottled filling defects on the various films. A roentgen diagnosis of possible endometrioma of the bowel was made with the note that malignancy could not be excluded.

The patient was admitted to the hospital and on September 16th was operated upon by one of us (G. F. M.). A large endometrial cyst was seen to involve the entire right ovary, which was approximately the size of a baseball. There were numerous dense adhesions throughout the pelvis. The uterus had been pulled over to the base of the bladder and was adherent to the sigmoid in the left portion of the cul-de-sac.

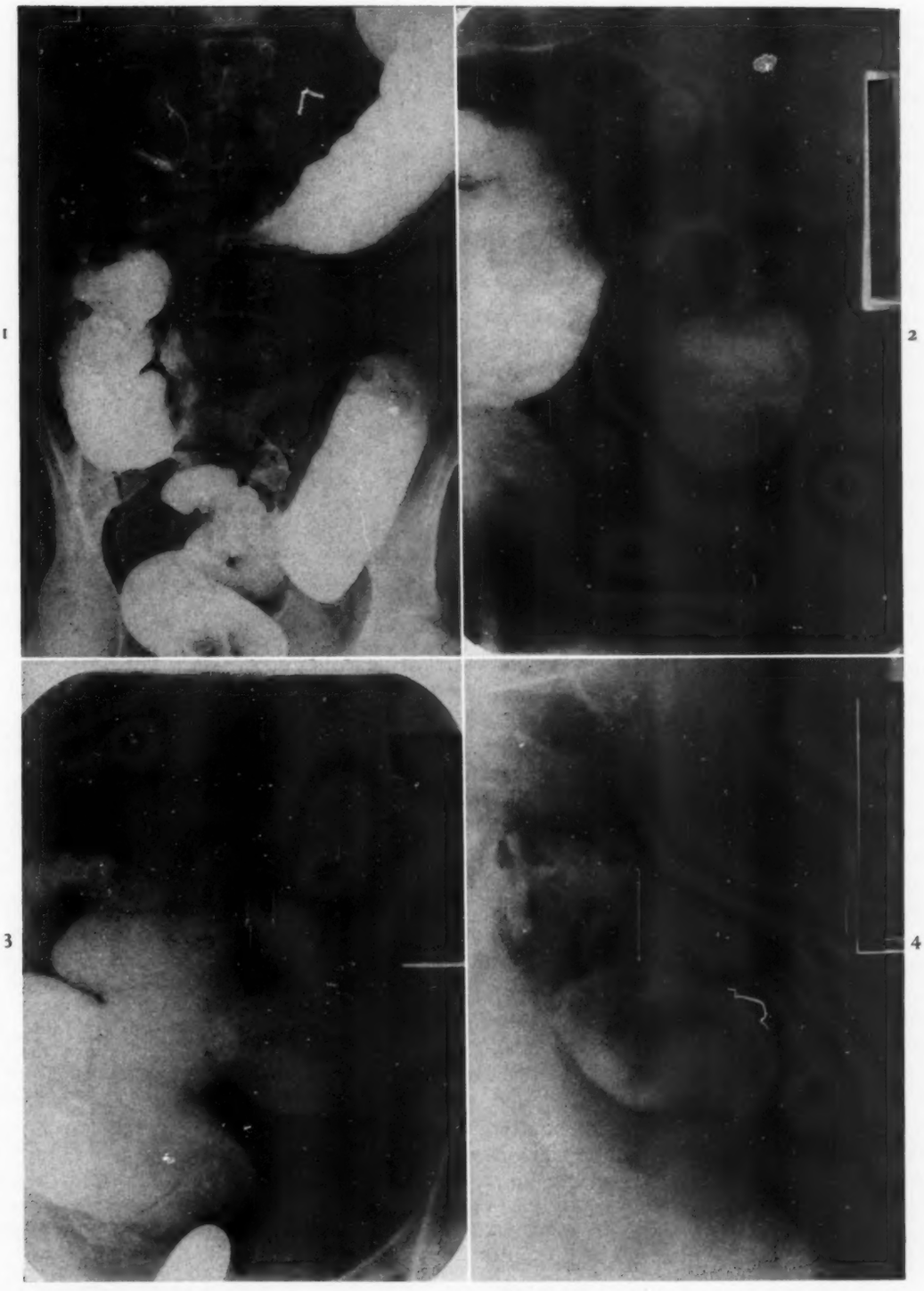

FIG. 1. Roentgenogram showing marked dilatation of the left colon due to the chronic obstruction in the sigmoid.

FIG. 2. Spot roentgenogram showing details of the endometrioma of the sigmoid colon.

FIG. 3. Roentgen appearance of the lesion in the sigmoid fourteen days following surgical castration, showing definite improvement in the mucosal pattern with diminution in the degree of obstruction.

FIG. 4. Roentgenogram of the endometrioma of the sigmoid colon taken thirty days following surgical castration, showing further improvement and widening of the lumen of the bowel.

There was a rock hard mass frozen to the lateral pelvic wall in the vicinity of the ureter and base of the bladder. Exploration of the upper abdomen was negative. A diagnosis of endometriosis with involvement of the sigmoid colon was confirmed and accordingly the right ovary, tube and body of the uterus were removed. The left tube and ovary had been removed elsewhere. Because of the marked fixation and the nature of the pathologic condition in the cul-de-sac it was impossible to do a total hysterectomy with any degree of safety. Efforts to dissect the rectosigmoid were abandoned because of the frozen nature of the mass and involvement of the tissues around the left ureter and the base of the bladder. A mid-transverse colostomy was carried out through a stab wound just to the right of the midline in the upper abdomen for decompression of the obstructed bowel.

The patient's postoperative course was uneventful. Inasmuch as the lesion itself could not be removed attempts were made to recover endometrial cells in the tissue from material obtained by rectal irrigation. These efforts were unsuccessful. A second effort at proctosigmoidoscopic examination was carried out on October 3rd. Because of the fixation it was impossible to pass the scope beyond 18 cm. and biopsy material obtained from that site failed to reveal any abnormality.

Pathologic report on the surgical specimen removed revealed a large chocolate cyst of the right ovary and extensive adenomyosis of the uterus.

Recheck roentgen study, using the barium enema, was performed on October 1st (Fig. 3) and October 16th. (Fig. 4.) The examinations revealed a persisting deformity and irregularity, and scarring with some narrowing at the site of the lesion in the sigmoid colon. There was very definite improvement as compared with the original study, with the partial obstruction having been resolved and the narrowed lumen of the bowel having increased in diameter by approximately two to three times. It was believed that the caliber of the bowel in the region of the lesion was adequate to permit closure of the colostomy without fear of recurring obstruction. This accordingly was accomplished on October 30, 1952. Since that time the patient's general health has been good. Her bowel function is essentially normal. Her libido has been unaltered and she has a normal sexual response.

SUMMARY

Endometriosis of the bowel producing obstruction and vicarious menstruation is sufficiently unusual to justify its presentation. Such a case is reported with a review of the more characteristic signs and symptoms. Favorable response to castration was obtained in spite of the extent of the lesion.

Addendum: Since this paper was submitted for publication one of us (G. F. M.) has had an additional case of endometrioma of the small intestine (ileum), for which a resection was carried out in an effort to relieve the obstruction. The patient's progress has been uneventful to this date.

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Unusual Type of Metastasis for Carcinoma of the Breast with Coincidental Development of Diabetes Insipidus

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CARCINOMA of the breast metastasizes by lymphatic spread or by the blood stream. In performing radical mastectomy we attempt to remove the tumor and all possible areas of lymphatic spread. In those 10 to 12 per cent that metastasize via the blood st eam, we are at a loss to prevent further involvement of distal organs and cannot tell which cases will develop distant metastases. A recent case of Dr. Urban Maes was so unusual that, with his permission, we would like to report it.

CASE REPORT

Mrs. R. S., age forty-five years, was admitted to Touro Infirmary on March 25, 1952, complaining of excessive menstrual bleeding. She stated that her last menstrual period began on March 2, 1952, and lasted approximately fifteen days. There were many large clots but no profuse flow and no pain associated with this period. There was no weight loss or any other symptoms referable to the lower abdomen. A review of symptoms was essentially negative except for a history of excessive thirst and urination. This was not a major complaint and was elicited only after questioning. The patient had had a previous admission to Touro Infirmary on March 10, 1950, complaining of a lump in the right breast which had been present for approximately three to four months. There was some increase in size during this period but no pain or discharge from the nipple. Physical examination at that time revealed a mass 1 inch in diameter in the left outer quadrant of the right breast. It was movable and not attached to the skin. On March 11, 1950, a frozen section of the excised biopsy revealed malignancy and a right radical mastectomy was performed. The excised breast showed a fibrous nodule measuring 2 cm. in diameter that microscopically showed sheets of poorly differentiated epithelial cells growing in a fibrous stroma. There was a tendency to be arranged in small glandular acini. (Fig. 1.) The remaining breast showed fibrocystic disease and a small fibroadenoma. The final pathologic diagnosis was scirrhous carcinoma, grade III, of right breast with metastasis to one of fifteen axillary lymph nodes examined. The postoperative course was excellent and she had had no signs or symptoms of recurrence at the time of readmittance to the hospital on March 25, 1952, for the excessive menstrual bleeding. Physical examination at this time revealed a blood pressure of 120/80; respiration, 20; pulse, 80, and regular. Examination of the eyes, ears, nose, throat, heart and lungs was within normal limits. Examination of the chest revealed a well healed scar of a right radical mastectomy with no evidence of skin or axillary recurrence. The size of the arms was symmetrical and function of the right arm was excellent. Abdominal examination revealed a mass below the umbilicus which was irregular and felt like a fibroid. Pelvic examination showed the uterus to be enlarged two to three times the normal size with most of the enlargement being in the fundus, probably due to leiomyomas.

On March 26, 1952, a laparotomy was performed and revealed several large fibroids of the uterus. Hysterectomy and bilateral salpingo-oophorectomy were performed in the usual fashion without any undue difficulty. Palpation of the peritoneum, aorta and liver revealed no evidence of metastasis of the breast carcinoma.

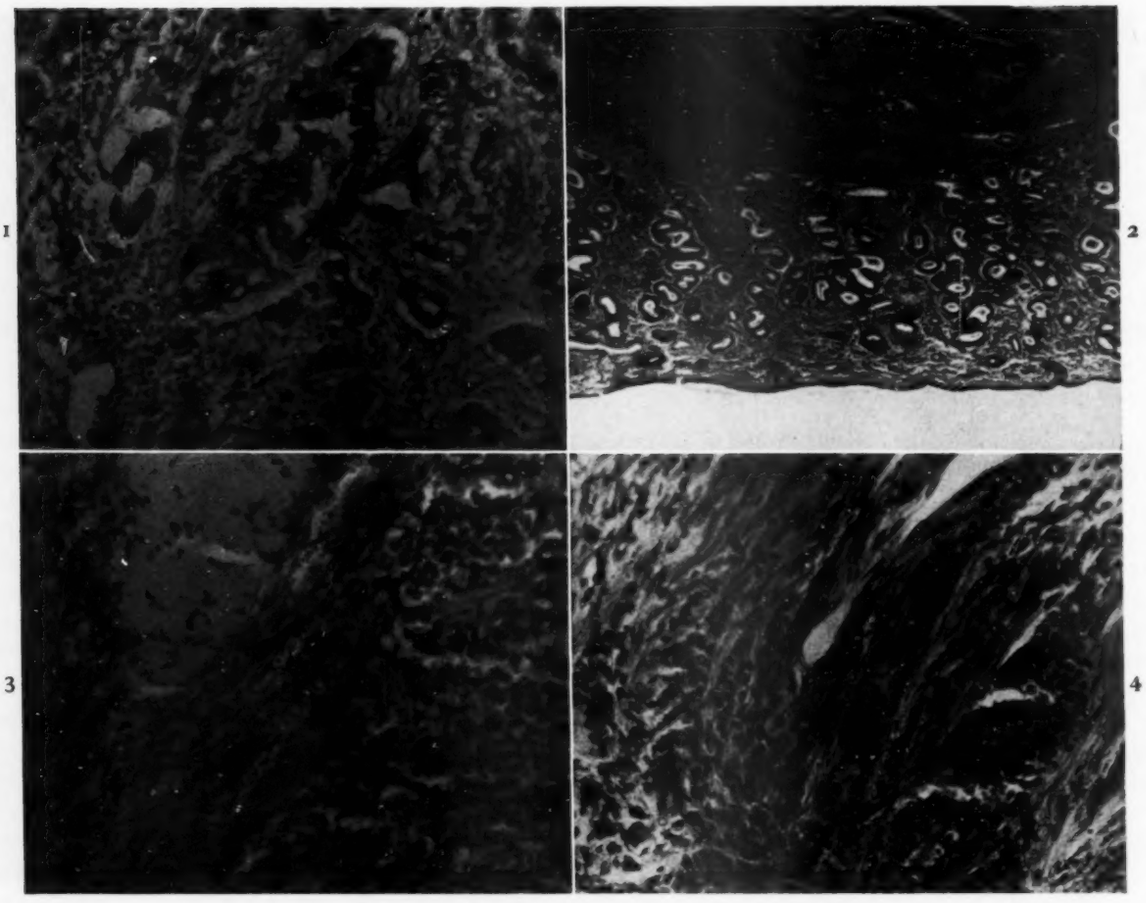

FIG. 1. Photomicrograph of carcinoma of breast removed in 1950. Note poorly differentiated epithelial cells in a fibrous stroma.

FIG. 2. Photomicrograph of uterus removed in 1952. Note normal endometrium.

FIG. 3. Photomicrograph of uterus removed in 1952. Note nest of poorly differentiated malignant epithelial cells within myometrium.

FIG. 4. Photomicrograph of ovary removed in 1952. Note nests at left side of field of poorly differentiated malignant epithelial cells.

Gross examination of the excised specimens showed the uterus to measure 14 by 12 by 6 cm. and to be deformed by multiple large leiomyomas situated in the fundus. Another smaller submucous leiomyoma was found. The cervix, tubes and ovaries were not remarkable. Microscopic examination showed multiple benign leiomyomas and a normal interval endometrium. (Fig. 2.) Routine sections of the myometrium showed the outer portions to contain nests of poorly differentiated neoplastic cells (Fig. 3) having the appearance of metastatic malignancy rather than a primary uterine carcinoma. One ovary also contained similar foci of metastatic poorly differentiated epithelial cells. (Fig. 4.)

On the day of surgery this patient's intake was 5,150 cc. and her output was 3,900 cc. On the first postoperative day her intake was 5,330 cc. and her output was 6,120 cc. She complained of excessive thirst and approximately every thirty minutes required some sort of fluid to quench this thirst. On the second postoperative day her intake was 4,770 cc., all oral, and her output was 4,575 cc. A check of the specific gravity on many of these urinary specimens revealed it to vary from 1.000 to 1.005. It was decided at this time that this patient probably had diabetes insipidus of unknown etiology. On March 29th insufflations of posterior pituitary powder were begun and the result was remarkable. For two and one-half hours prior to the use of posterior pituitary powder the patient's intake was 1,100 cc. and her output

was 1,000 cc. In the eight hours following nasal insufflation of posterior pituitary powder her intake was only 200 cc. and her output 350 cc. For the rest of her postoperative period and since that time she has been on two to three nasal insufflations of posterior pituitary powder in twenty-four hours and has had a normal intake and output.

On March 31, 1952, x-rays of the skull revealed no evidence of bony metastasis. The sella turcica was normal with no erosion of the clinoid processes. Urine was negative for sugar and microscopic examination was negative. The blood glucose was 85 mg. per cent and the nonprotein nitrogen was 35 mg. per cent.

COMMENTS

The unpredictable course of metastasis from a carcinoma of the breast is well known. With no evidence of pleural involvement, pulmonary, liver, or other intra-abdominal metastasis, it is difficult to explain how blood born metastasis would seek out the myometrium of the uterus and interstitial tissues of one ovary to the apparent exclusion of organs such as the liver and lungs. We have no explanation for the bizarre type of isolated metastasis sometimes seen in malignancies of the breast. The normal uterine mucosa, the isolated foci of metastasis in the myometrium, and one ovary, and the similar histologic cell type all are in favor of metastatic malignancy rather than another primary carcinoma in one ovary or uterus.

The other clinical curiosity concerning this patient would be abrupt development of diabetes insipidus. In spite of all examinations we have been unable to determine the etiology of this condition. A first thought would be cerebral metastasis from the breast carcinoma to the posterior pituitary or hypothalmic areas of the brain. X-rays of the skull at that time failed to reveal any evidence of metastasis to the skull with particular reference to the sella turcica. The fact that the diabetes insipidus had persisted sixteen months is very much against the presence of cerebral metastasis in any form. The usual causes of diabetes insipidus, such as sequelae to meningitis, encephalitis, head injuries with brain damage have all been eliminated in this patient. It would seem best to classify her as a case of probably true idiopathic diabetes insipidus. Treatment has consisted of intranasal insufflation of posterior pituitary powder as necessary to control the symptoms. At present these insufflations are necessary approximately three times in twenty-four hours. The patient is quite comfortable and is entirely asymptomatic except for occasional nasal itching due to irritation of mucous membranes from the powder.

SUMMARY

A case is presented of a forty-five year old female who had a radical mastectomy for carcinoma of the breast in 1950. In 1952 following panhysterectomy for uterine leiomyomas, isolated metastasis was found in one ovary and the uterine myometrium. The simultaneous development of diabetes insipidus could not be explained on cerebral metastasis. The patient is living and well three years following the mastectomy and fourteen months following the panhysterectomy, with no evidence of cerebral metastasis.

Traumatic Perforations of Colostomies

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A THOROUGH review of the literature from 1916 to the present reveals very few reports of traumatic perforations of colostomies. Table 1 lists these reported cases. The authors believe that this complication, though unusual, must occur more frequently than these sporadic reports would indicate. Therefore we are reporting two other cases, bringing the total number reported to thirteen. (Table 1.)

We believe that perforation of a colostomy, like a visceral perforation anywhere, is a potentially fatal event. As such its occurrence should be brought to the attention of all physicians, surgeons and nurses. Because the care of the colostomy is now somewhat standardized, irrigations in the hospital are frequently done by inexperienced orderlies or aides. This may lead to undue trauma and resultant perforation. However, of the eleven reported cases (including the authors' cases) only two occurred in the hospital. This means that the danger is as great, if not greater, in the hands of the very individual whose life is at stake.

The saddest aspect of this complication is that a patient cured of carcinoma by a radical operation, or with a colostomy for a benign condition (one of the cases reported by the authors), may meet a fatal outcome because of a surgically caused artificial anus. Therefore it behooves us to be as analytic as possible in considering the methods of care of a colostomy. It may be necessary for us to change the standardized methods in use at present.

Although most observers agree that the basic cause of a traumatic perforation is undue force on the part of the irrigator, it is believed that this is not the sole factor in the production of the rent in the bowel. Mallory[1] is of the opinion that the tip of the enema tube, by its repeated use and motion, causes abrasions in the mucosa of the bowel. He states that organisms invade the wall at this site or injury, or as a result of the lowered resistance on the part of the patient, and produce infection with subsequent destruction of the wall leading to perforation. Silvers[2] cautions against the use of force or large stiff tubes in the care of colostomies. Davis[3] speaks of the angulation of the bowel produced by a short mesocolon with the resultant repeated pressure of the enema tube at this point of angulation, leading to pressure necrosis and perforation. Bettman et al.[4] hypothesize a wave of peristalsis coincidental with the insertion of the catheter, producing a firmness or rigidity of the bowel so as to produce a situation "similar to driving a pin through a metal disc if it is encased in a piece of cork."

The clinical picture produced by the perforation is similar to that produced by perforation of the intestine elsewhere. This involves sudden pain and shock with the development of signs of a localized or generalized peritonitis. The treatment of this condition is immediate exploration with the location of the perforation. When this has been done, one of several paths may be followed. The segment of bowel involved may be resected and a new colostomy brought out on the abdominal wall. However, sometimes, the location of the perforation, or the adherence of other intestinal loops to this area of peritonitis prevents this method of treatment. One may then close the perforation and drain this region. In some cases (the second case reported here) closure is impossible. A defunctionalizing colostomy proximal to the first one with drainage down to the perforation may be done in this emergency situation.

We have deliberately avoided any recommendations with respect to incisions, since this will be determined by the type and position of the previously created colostomy.

Several methods have been suggested to prevent the occurrence of this complication. Lahey[5] advises that the catheter be greased well and inserted for six inches or its full length. Davis[3] quotes the technic of Vernon C. David which involves the use of a catheter, the tip of which is placed through an inverted rubber

nipple. The nipple, with the catheter, is then inserted into the colostomy, acting as a cork when the fluid is inserted into the bowel. The short segment of catheter protruding through the nipple does not allow the tube to strike the bowel wall, thus avoiding necrosis with subsequent perforation. Wiley and Sugarbaker[6] also recommend lubrication of the catheter with petrolatum, insertion for six to eight inches, and preventing regurgitation of irrigating fluid by the use of a nipple with the end cut off so that a catheter can be passed snugly through it and then inserted into the colostomy stoma.

The authors wish to suggest the use of a lubricated Foley catheter, with a 5 cc. capacity rubber bag, instead of the firm rubber catheters and enema tubes now in use. This will yield a combination of the features of the foregoing methods. The technic is simply the insertion of the catheter into the colostomy, only far enough to have the balloon inside the bowel, but not necessarily beneath the level of the abdominal wall. The balloon is then inflated and the enema administered. There is no leakage. This method has been used by us successfully in the management of colostomy irrigations.

TABLE 1

REVIEW OF LITERATURE ON TRAUMATIC COLOSTOMY PERFORATIONS

Author	Case	Site of Perforation	Symptoms	Cause	Treatment	Outcome
Mallory, 1936[1]	46 yr. old; Miles', for carcinoma	Close to colostomy	Distention, pain, vomiting, peritonitis	Abrasion ↓ Infection ↓ Perforation	?	D* (no recurrence on autopsy)
	Fatality recalled by author	N.D.*	N.D.		?	?
	Fatality recalled by author	N.D.	N.D.		?	?
Silvers, 1940[2]	Case 5 yr. after Miles'	N.D.	N.D.	Force on tube	.....	?
Davis, 1947[3]	77 yr. old; Miles' done 1 yr. before	Medial	Pain	Enema tube ↓ Pressure necrosis at angulation ↓ Perforation	Laparotomy (N.F.S.)	R*
	53 yr. old; Miles' done 6 wk. before	Medial	Generalized peritonitis		Laparotomy (N.F.S.)	R
	58 yr. old; Miles' done 2 days before; enema administered	Abscess drained 3 wk. later	Localized peritonitis		Laparotomy (N.F.S.)	R
Greene and Greene, 1952[5]	70 yr. old; Miles' done 3 mo. before	Posterolateral wall, 8 cm. from opening	Pain, shock	Quotes above explanation	Resection; new colostomy	R
Bettman, Richter and Drugas, 1953[4]	65 year old; Miles' done 4 mo. before	7.5 cm. from opening	Pain, shock	Peristaltic rigidity of bowel with trauma	.....	R
Copper, 1953[7]	61 yr. old; Miles' done 1 yr. before	7.5 cm. from opening on the antimesenteric border	Pain, distention	Force on enema tube	No drainage; laparotomy; closure of perforation	R
	70 yr. old; Miles' done 2 yr. before		Pain, distention	Force on enema tube	Proximal colostomy, drainage	R
Authors' cases (two)	See text of article					

* N.D., not described; D, death; N.F.S., nothing further stated; R, recovery.

CASE REPORTS

CASE 1. J. S. (Hospital No. U-39280), a fifty-nine year old white man, was admitted with a proven diagnosis of adenocarcinoma of the rectum. On December 25, 1945, a Miles abdominoperineal resection was performed. The postoperative course was uneventful up to the morning of the day of discharge, January 18, 1946. Immediately following the ad-

ministration of a soap suds enema (1,000 cc.) by the orderly, the patient experienced severe abdominal pain. Distention and rigidity of the abdomen developed. Roentgenograms revealed the presence of air beneath the diaphragm. An exploratory laparotomy was performed and a 2 cm. long laceration was found on the posterolateral surface of the sigmoid, approximately three inches from the colostomy opening, but within the peritoneal cavity. The hole was sutured and the area drained. The patient eventually recovered but the postoperative course was complicated by the occurrence of a bout of intestinal obstruction (cured by operative intervention), a pelvic abscess, a left hemiplegia and cardiac decompensation.

CASE II. H. V. (Hospital No. U95237), a thirty-eight year old obese white woman, was admitted on the gynecologic service because of a painful mass in the left adnexal region. At operation on November 17, 1952, the sigmoid colon was found adherent to the uterus and left adnexal region. The sigmoid was thin-walled in places because of multiple diverticula. Because of this primary condition and because of surgical trauma to the mesentery of the sigmoid, a proximal sigmoid colostomy had to be performed. Postoperatively a pelvic abscess developed and resolved under antibiotic therapy. The patient was discharged December 13, 1952. On the night of January 22, 1953, while trying to give herself her daily colostomy enema, she found that the soft rubber catheter met an obstruction. She continued to apply pressure until the tube entered the bowel. After giving herself the soap suds enema, she experienced immediate severe abdominal pain. During the night her distress continued and she began to vomit. She reported to the hospital early the next morning where the diagnosis of an acute peritonitis was made. Laparotomy was performed after the patient was in electrolyte balance. A perforation was found on the medial aspect of the sigmoid colon, four inches from the colostomy opening and at the peritoneal level. Because of a short sigmoid mesentery and the critical condition of the patient, it was deemed inadvisable to carry out the mobilization which would have been necessary to close the perforation. A proximal defunctionalizing transverse colostomy was performed. The postoperative course was uneventful except for a low grade wound infection which responded to antibiotics.

SUMMARY

1. The literature covering perforation of colostomies is reviewed.

2. The proposed theories of causation are summarized.

3. Methods of prevention are discussed with a proposal by the authors for the use of a Foley catheter in irrigating colostomies.

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Hemangiopericytoma of the Ileum

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TUMORS of the small intestine with the exception of metastatic growths are infrequently encountered. The findings which we are presenting are very rare as we were unable to find a similar case in the literature.

CASE REPORT

The patient (Hosp. No. 5110–377), a forty-three year old single white woman, was referred to our service at the hospital on October 14, 1951. Her chief complaint was a tumor in the lower abdomen and associated intestinal cramps. She had noticed intermittent abdominal cramps for a period of about twelve months, and a gradual enlargement of the abdomen. There was nausea and occasional vomiting during these episodes. About six weeks before she entered the hospital she consulted her doctor, who treated her for a viral infection. She recovered from this disease in a short time, but during routine examination a large pelvic tumor was discovered and surgery advised.

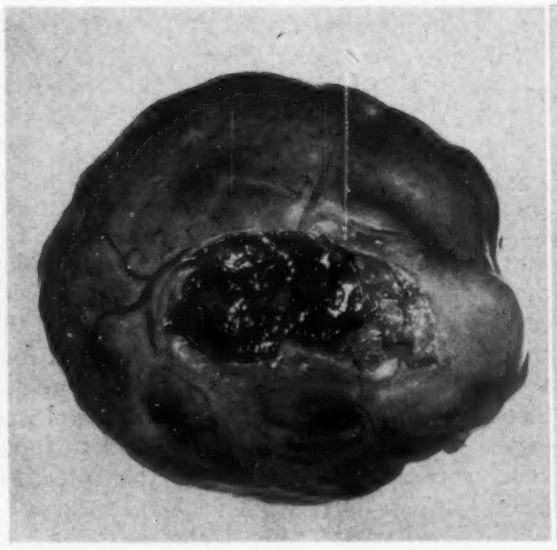
Her past history was essentially negative. Menstruation began at the age of thirteen, twenty-eight-day type, regular flow, lasting four or five days, profuse. Her last menstrual period was on September 6, 1951.

Physical examination was negative, except for a large tumor extending upward from the pelvis to about 3 cm. from the umbilicus. Bimanual examination of the pelvis revealed a large tumor that was rather globular in shape with the consistency of an ovarian cyst. The cervix and uterine body were normal. Our impression was that of an ovarian cyst. Laboratory findings showed the urinalysis to be negative. Hemoglobin was 13.0 gm., erythrocytes 4.24 million, leukocytes 9,250 with 71 per cent neutrophils. Serology was negative as was an x-ray of the chest.

Preoperative diagnosis was large right ovarian cystoma. On October 15, 1951, an abdominal exploration was carried out under pentothal® cyclopropane anesthesia. Upon opening the abdomen a cystic mass, approximately 14 cm. in diameter, was found attached to the antimesenteric portion of the ileum about four and a half feet from the ileocecal junction. The blood supply was marked from the bowel wall to the tumor with several large and tortuous veins entering the cyst from the intestinal tract.

The blood vessels were ligated near the base of the tumor, and after incising the peritoneum around the attachment enucleation of the cyst was accomplished without difficulty—practically a bloodless procedure. The serosa on the intestine was easily repaired, closing the raw surface with No. 00 chromic catgut. No resection was necessary. The appendix was routinely removed. The abdomen was closed in our usual manner and the customary postoperative treatment administered.

Pathologic report revealed that the specimen consisted of a cystic tumor excised from the antimesenteric border of the ileum, approximately four and a half feet above the ileocecal valve. The entire cystic mass measured 10 by 12 cm. and the point of attachment to the ileum measured 5 by 2 cm. The surface of the cyst was smooth and of rather dark brown color. Widely distended veins extended into the area of attachment. Upon further opening of this cyst it was found to contain a brownish grumous fluid and particles of necrotic coagulum. The cyst wall measured 2 to 3 mm. in thickness and had a fairly smooth lining, except near its border of attachment where it appeared elevated by the accumulation of fat beneath it. Corresponding to the area of attachment was a mass protruding into the cyst which measured 6 by 5 cm. and 2½ cm. in its greatest thickness. The surface of this protruding mass was covered with necrotic coagulum and upon cut section this rather solid but firmly honeycombed structure had much of the appearance of compressed, moderately hemorrhagic placental tissue, including a central area of whitish infarcted character. Adjacent to this was a



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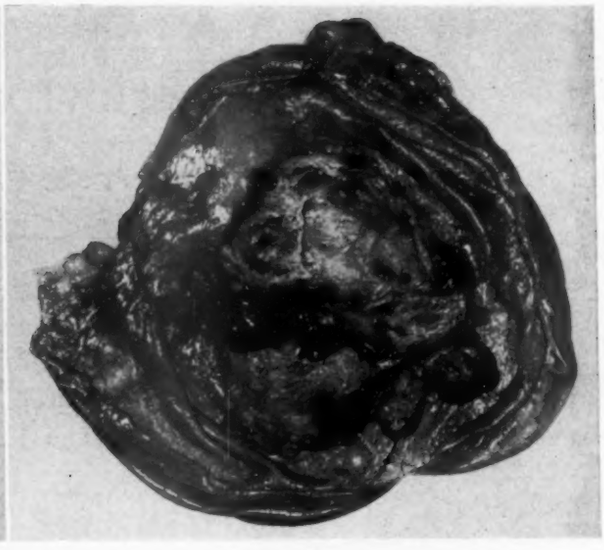

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FIG. 1. Showing the dark surface of the cyst where it was attached to the ileum.

FIG. 2. Showing the cyst after it was opened.

thickened mass of yellowish gray tissue measuring 5 by 3 by 2½ cm. The appendix accompanying this specimen measured 7 by ½ cm. and was somewhat impacted; the wall was thickened.

Microscopic sections of this tumor showed the material at the base of the cystic area to be that of hemangiomatous character, with degeneration of interstitial tissue with fairly well preserved wide vascular spaces surrounded by a few spindle cells. This process continued into the wall of the cyst. The adjacent nodular area at the base of the tumor was found to be composed of bundles of spindle cells, which on trichrome staining did not stain as smooth muscle or nerve cells, establishing this tumor as originating from a type of tissue different from muscle or nerve. These spindle cells, within the solid portion, were similar to those surrounding the vascular spaces and must be considered as pericytes. As such the tumor represented a rather unusual group of benign tumors known as hemangiopericytomas. (Figs. 1 and 2.) Diagnosis was hemangiopericytoma of the ileum.

Because of the position of the cyst on the bowel we were sure that we were not dealing with a Meckel's diverticulum; however, the color and content of the cyst looked like a possible endometrial development. It was neither of the foregoing but proved to be a hemangiopericytoma of the ileum.

Osteochondroma of the Astragalus

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OSTEOCARTILAGINOUS exostosis (osteochondroma) of the astragalus is an exceedingly unusual occurrence. Only three instances involving the astragalus were encountered in the 310 osteochromas personally reviewed by Geschickter and Copeland.[2] Two instances of "ankle" involvement among 513 exostoses are recorded in the files of the Armed Forces Institute of Pathology.[1] Of eight "less common lesions of the astragalus," encompassing three tumors, Lewis[3] reported only a single case of osteochondroma. It is believed, therefore, that the report of the following case is justifiable.

CASE REPORT

A. P., a thirteen year old white schoolboy, was first seen in March, 1947, with a chief complaint of slowly progressive painless swelling of his left ankle of two years' duration. Family history and previous health and illnesses were essentially non-contributory. His present illness began without known precipitating or exacerbating event in 1945, when he first noted a painless "lump" on the outer side of his left ankle. There was no known antecedent trauma nor any localized infectious process. The "lump" had insidiously appeared, progressed slowly in size and had been associated with inversion of the foot. It remained entirely painless until about one month prior to examination, at which time the patient first noticed pain on weight-bearing.

Pertinent physical findings were entirely limited to the region of the left ankle. There was a pronounced tumefaction on the lateral aspect which clinically gave the impression of an enlargement of the distal extremity of the fibula. The foot was moderately inverted with slight adduction of the forefoot. (Fig. 1.) There was no limitation of motion at the astragalocrural joint. A slight degree of inversion was possible at the subastragalar joint but eversion, even to the neutral position, was completely impossible. The mid-tarsal joint was not impaired and motion of all of the joints of the metatarsals and phalanges was physiologic. There were no signs of inflammation or circulatory disturbance.

FIG. 1. Photograph showing tumefaction in the region of the lateral malleolus with moderate inversion of the foot and slight adduction of the forefoot.

Radiographic examination disclosed a somewhat elliptic mass arising from the posterior portion of the outer wall of the left astragalus. (Fig. 2.) The outer wall of the tumor impinged against the posterior aspect of the lower end of the fibula, forming a sort of shallow acetabulum with which the tumor appeared to articulate. The surface of the mass appeared rounded and quite smooth and did not give any roentgenographic evidence of malignancy.

Owing to progressive deformity, limitation of subastragalar joint motion and to recent pain on weight-bearing, operative intervention was advised. The excision was performed by

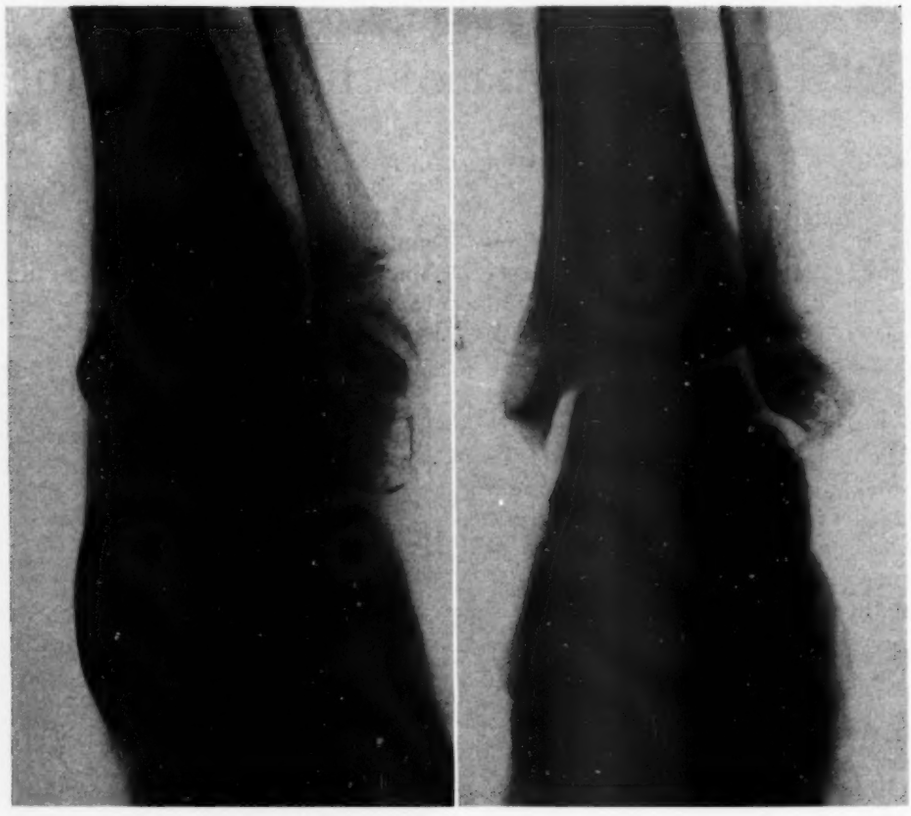

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FIG. 2. Roentgenogram disclosing osteochondromatous mass arising from the posterior portion of the outer wall of the left astragalus.

FIG. 3. Roentgenogram taken five years after operation showing an incurving of the tip of the lateral malleolus and a slight abnormal convexity of the lateral wall of the astragalus.

Dr. Henry Milch on March 12, 1947. "With the patient in the prone position and under general anesthesia, a three-inch incision was made postero-laterally over the inferior tibiofibular joint. By gently retracting the muscles to either side, the posterior surface of the astragalus was gradually exposed. The astragalo-crural joint was then opened disclosing the tumor. A single large osteochondral fragment was removed and thereafter the attachment of the tumor to the outer wall of the astragalus was readily visualized. The outer wall of the astragalus bearing the tumor was then excised *en bloc*. The wound was closed in layers without drainage and a thick elastic dressing was applied to obliterate the dead space." The patient had an uneventful postoperative course and was discharged walking on the fourth hospital day.

Gross and microscopic pathologic examination was made by Dr. J. Erlich at the Lebanon Hospital. The specimen measured 3 by 3 by 2 cm. and had a sessile pedicle and a smooth surface. Occasional eburnating areas were seen and one aspect of the tumor mass was noted to be quite porotic. On section, a thin outer compact layer was seen and the remainder of the specimen, save for a cystic area at one end, was light yellow and homogeneous. Histologic examination revealed a "benign osteochondroma."

The patient made an entirely uneventful recovery and resumed his normal activities. When re-examined in September, 1952, five years after operation, a slight varus of the heel still persisted. Although there was slight limitation of subastragalar motion, the patient experienced no inconvenience. Roentgenogram (Fig. 3) revealed an incurving of the tip of the lateral malleolus and a slight abnormal convexity of the lateral wall of the astragalus.

COMMENTS

Osteocartilaginous exostoses are unquestionably the most common of all skeletal tumors. Essentially benign, they are usually solitary excrescences of cancellous bone and tend to occur primarily in white males during the first two decades of life. For the most part, they behave with respect to growth like endochondral bone elsewhere in the body. Since they tend to be clinically silent or but minimally symptomatic, medical attention is usually sought only after the occurrence of (1) visible deformity, (2) painful secondary adventitious bursae, (3) limitation of motion of adjacent joints or (4) when so-called "pathologic" fractures supervene. Quite irrespective of the presenting complaint, diagnosis is virtually always provided by roentgenographic examination.

Characteristically, a cancellous bony projection is found in the affected area growing by means of either a pedunculated or sessile base from the cortex of the underlying bone. The lesions usually arise at or in close proximity to the ends of the long tubular bones although very occasionally, as in the case reported herein, they may affect the short bones. On section they typically show a cancellous excrescence capped by a variably thick bosselated layer of hyaline cartilage, the perichondrium of which blends with the thickened periosteum of the parent bone.

In most instances these outgrowths continue to enlarge until the time of general closure of epiphyseal plates when their own cartilagenous caps undergo involution and become ossified. Cartilaginous remnants, however, not infrequently persist even in such osteomas and these appear to retain at least a latent capacity for renewed growth. This may be manifested by continued growth of the tumefaction even considerably after epiphyseal closure or by sarcomatous alteration of the previously benign lesion. The latter complication, however, is exceedingly rare and occurs in probably less than 1 per cent of the cases of isolated tumors. In cases of multiple osteochondromatosis (diaphyseal aclasis or hereditary deforming chondrodysplasia), on the other hand, the incidence of malignant transformations is variably reported to be as high as about 10 per cent.

In this connection, therefore, it becomes of some importance to differentiate clearly true multiple (periosteal) osteochondromatosis from the solitary type as well as from the closely related, perhaps similar disorder, Ollier's disease (dyschondroplasia or endosteal osteochondromatosis). In the latter there is no genetic pattern, the metacarpals, metatarsals and phalanges are more typically the involved bones; and the lesions lie within the metaphyses and hence are essentially endosteal. Osteochromas are by definition periosteal tumefactions. Furthermore, "while any metaphysis may be the site of an osteochondroma, the more frequent sites in the approximate order of their frequency are the lower femur, upper tibia, upper femur, upper and lower humerus, lower tibia, pelvis and vertebrae."[5]

One further lesion, moreover, must occasionally be considered in the differential diagnosis, namely, the recently described entity of periosteal chondroma.[4] Here again radiographic examination is of paramount importance. This latter tumor differs from enchondromas in not involving the interior of bones and from osteochondromas in that the cortex is not defective at the tumor site. In addition, the characteristic declivity in the underlying bone and the appreciable sclerosis of the contiguous cortical bone seen in this entity serve as distinguishing features.

Thus with (1) a typical history of slowly progressive swelling often associated with secondary mechanical abnormalities and (2) careful roentgenographic examination, a diagnosis of osteochondroma can usually be established with ease. In certain instances, however, largely attributable to location of the lesion, diagnosis may be somewhat more difficult. This appears to be especially true of the astragalar involvement where the problem of differentiating osteochondroma from enchondroma may occasionally arise.

SUMMARY

An unusual case of osteochondroma of the astragalus and a brief general review of osteochondromas are presented.

Addendum: Since this article was accepted for publication another case has been reported (Rook, F. R. Intra-articular osteochondroma of the astragulus. *Am. J. Surg.*, 85: 807, 1953).

Acknowledgment: The writer would like to express his thanks to Dr. Henry Milch for per-

mission to publish this case and to Dr. J. Erlich of the Lebanon Hospital, New York, N. Y., for permission to cite material reviewed by him.

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Druckerman et al. recently contrasted a group of duodenal ulcer patients treated by subtotal gastrectomy with another group in whom infradiaphragmatic vagotomy was also performed at the same time. These two groups comprised 322 consecutive patients with chronic duodenal ulcer who were subjected to surgery. The studies by Druckerman et al. indicate that a slightly better result and more complete gastric anacidity followed the combined operations and that recurrences were less; however, several of these latter patients sustained a greater postoperative morbidity such as diarrhea. Hence one cannot yet be certain that simultaneous vagotomy is advisable; and until further studies give us the answer, it seems that radical subtotal gastrectomy should suffice. (*Richard A. Leonardo, M.D.*)

Primary Carcinoma of the Liver Presenting Itself As an Acute Abdominal Condition

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PRIMARY carcinoma of the liver is a rare disease in North America and in Europe. In America it is seen in 0.25 per cent of all autopsies, and comprises 2.1 per cent of carcinoma.[1] Of the two common types of carcinoma of the liver the "liver cell" type (hepatoma) is much more common than the "bile duct" type (cholangioma). Cirrhosis of the liver is associated with the liver cell type in 85 per cent of cases, whereas in the bile duct type it is seen in only 30 to 50 per cent of cases.[2]

This case is presented because of the rarity of the bile duct type of primary hepatic carcinoma and because of the unusual manner in which it presented itself clinically.

CASE REPORT

A forty-three year old white man was admitted to the hospital with a chief complaint of severe abdominal pain. He was apparently well until three weeks prior to admission when he began to have loose bowel movements. The stools were poorly formed and were brown colored. Tarry stools were denied. Ten days prior to admission vague upper abdominal pain developed. There was no radiation of the pain or association with meals. Three days prior to admission the upper abdominal pains became stabbing in nature and remained localized to the epigastrium. There was no nausea or vomiting. At this time the patient began to feel warm. The temperature, taken by the patient, ranged between 100 and 103°F. There was a 15 pound weight loss.

Past history, family history and system review were non-contributory.

Physical examination revealed a well developed, well nourished white male appearing acutely ill, complaining of abdominal pain. The temperature was 100.4°F. Blood pressure was 130/80 mm. Hg. The pulse was 96 per minute. The skin and scleras were not icteric. Heart and lungs were normal. The abdomen was not distended. On palpation there was a board-like rigidity of the abdomen. The upper abdomen was exquisitely tender to touch, with marked generalized rebound tenderness. Peristalsis was hypoactive. Palpation of the liver, spleen and kidneys was not possible because of the extreme tenderness and rigidity.

Laboratory studies showed the urine to be negative except for a 4 plus sugar and 0 acetone. Blood studies revealed a 4.5 million red cell count, and a white cell count of 14,500, with 73 per cent neutrophils, 25 per cent lymphocytes and 2 per cent monocytes. The serum amylase was 60 mg.

Upright film of the abdomen revealed a questionably enlarged liver. There was no air under the diaphragm.

With a presumptive diagnosis of a perforated peptic ulcer, the patient was explored on the day of admission.

At operation, upon opening the peritoneum the lower border of an enlarged liver came into view. This enlargement could not be palpated previous to surgery because of the extreme rigidity of the abdomen. No fluid escaped from the incision. On examination the liver was found to be enlarged, hard and studded throughout with numerous carcinomatous implants. The liver appeared to be completely involved. The implants varied from the size of a golf ball down to a pea. A tentative diagnosis of metastatic carcinoma was made. A general examination of the abdomen was begun to determine the source. The gallbladder was inspected and found to be soft and easily collapsible. No stones were found. The common bile ducts were then inspected and appeared to be of the proper size and consistency. The inspection was carried out by means of inserting the index finger of the left hand into the

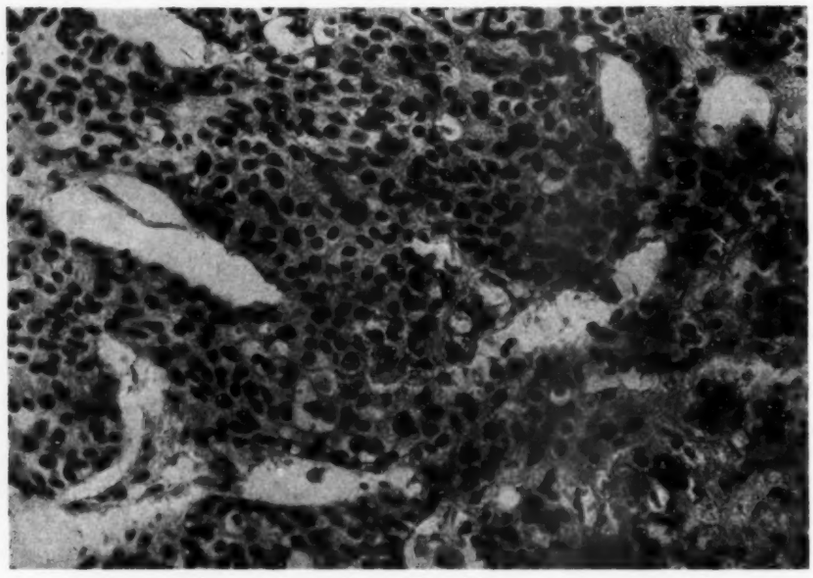

FIG. 1. Microscopic section of liver biopsy in case presented.

foramen of Winslow, palpating the portion of the duct within reach. Later on an examination of the common duct was carried out visually. The duodenum was inspected together with the stomach; neither showed any pathologic condition. The rectum, sigmoid, ascending colon and transverse colon were carefully inspected together with the right colon; no pathologic disorder was noted. The small bowel was likewise inspected, and this also did not show any gross pathologic condition. Both kidneys were palpated and found to be of proper size and consistency and were freely movable. Suprarenal glands were not enlarged and did not reveal any palpable disorder. Hence we were at a loss to find the origin of the carcinoma. The prostate gland was palpated within the abdomen; no focal point was seen. Two biopsies were then taken from the edge of the liver in entirely separate areas. One area failed to bleed. In the other area by means of atraumatic sutures of chromic No. 0 catgut hemostasis was secured. Omental tab was then tied in to the area to act as hemostasis. Sponge count was reported correct and the abdomen was closed in layers with the usual type of sutures without drainage. Chromic No. 0 catgut was used for the peritoneum, interrupted chromic No. 1 catgut was used to close the fascia; superficial fascia was approximated with single plain No. 1 and the skin was closed with interrupted sutures of deknatel in the fashion of Stewart. At the conclusion of the operation a rectal examination was performed in order to rule out an initial rectal lesion. The prostate and rectum did not reveal any pathologic disorder whatsoever.

Pathologic report: Grossly, the specimen consisted of two firm dark reddish blue triangular-shaped pieces of liver tissue measuring about 1 cm. in diameter. The cut surface showed whitish nodular mottling. Microscopically, the lobular architecture of the liver was deranged by numerous disseminated neoplastic foci of small closely packed and partially coalescing alveoli which were lined with cuboidal cells composed of a pale-staining cytoplasm and dark-staining slightly pleomorphic nuclei. There were scattered areas of necrosis and hemorrhage. Pathologic diagnosis was multiple disseminated bile duct carcinoma of the liver. (Fig. 1.)

The patient made an uncomplicated recovery. The temperature returned to normal on the second hospital day and abdominal pain subsided. The tenderness decreased gradually.

Follow-up laboratory studies revealed an elevated fasting blood sugar of 220 mg. An oral glucose tolerance test revealed a typical diabetic curve. Tests for liver function showed the following: the icteric index, 6.5; van den Bergh, immediate direct and 4.3 mg. indirect; bromosulfalein test, 14.7 per cent retention after thirty minutes. The total protein was 6.8 gm., albumin 4.82 gm., globulin 1.98 gm. The alkaline phosphatase was 6.7 units; cephalin

flocculation 4+ in twenty-four hours; thymal turbidity 4 units. Prothrombin time (done twice) was 56 per cent. The patient was discharged on 10 units of NPH insulin, to be followed in the outpatient department.

SUMMARY

A case of "bile duct" type (cholangioma) carcinoma of the liver making its appearance as an acute condition of the abdomen is presented.

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Human semen and prostatic fluid contain important factors that tend to prevent or control genitourinary infections. Besides, since the cervical cultures of many women demonstrate Escherichia coli which are definitely spermicidal, these protective agents in the male ejaculatory fluid may render pregnancy more possible. One of these antibacterial factors in the human semen and prostatic fluid is heat labile. Capable of extraction by acid alcohol, it is lysozyme or a similar product and is resistant to the Micrococcus lysodeikticus. The other portion of the fluid's antibacterial factors is heat stable and non-extractable by acid alcohol. It is antagonistic to gonococci, Bacillus cereus, Staphylococcus aureus, Escherichia coli and others. (*Richard A. Leonardo, M.D.*)

Intussusception of Ileum with Expulsion of Intussusceptum per Anum

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THE occurrence of intussusception in the adult is in itself a rarity, but its occurrence, first without demonstrable cause, and second followed by spontaneous amputation, expulsion of the sequestrated intussusceptum, and auto-anastomosis, represents a surgical curiosity. The incidence of this phenomenon in a patient who had not experienced previous abdominal surgery and who survived the episode prompts this report.

The case herein reported is one of ileo-ileal intussusception with amputation and expulsion per anum of a segment of ileum measuring 45 cm. in length. The patient's survival was, however, not entirely without symptoms and this lead to subsequent surgery which revealed the curious mechanism that had evolved spontaneously.

CASE REPORT

W. J., a sixty-three year old white male, was admitted to the Hahnemann Hospital on September 9, 1951, with a chief complaint of abdominal pains of four days' duration. There was rather sudden onset of cramp-like pains with frequent loose and pale or light-colored stools for the first twenty-four hours of illness. The forty-eight hours prior to admission were characterized by only one bowel action daily but this was watery; crampy pains persisted. The patient stated that he had had a similar episode lasting four to five days several months previously when he also had a "heart attack." Pain was usually of varying duration but always cramp-like and frequently seemed to be precipitated by the ingestion of milk, eggs or bacon. He stated further that this food intolerance had, for many years, also resulted in episodes of diarrhea, on occasion with abdominal pain. He had vomited several times with this episode and had retained very little liquids and no food in the preceeding four days. Of the past history, it was elicited that he had been under treatment for "heart trouble" for several years and was taking digitalis daily. There was no history of hemoptysis or embolic phenomena, but exertional dyspnea, orthopnea and ankle edema was experienced; he had had several episodes of "heart failure." He denied other serious illnesses, surgery, injuries or venereal disease.

Physical examination revealed a sallow complexion, obvious weight loss, a generally poor nutritional state and moderate cyanosis of lips and nail beds. The patient was in moderate to severe pain pointing with his hand to an area of maximum distress in the mid and left upper and left lower abdominal quadrants. The skin and mucous membranes were dry. Heart findings consisted of a normal sinus rhythm with a grade II blowing systolic murmur with maximum intensity over the apex; no gross cardiomegaly was determined. Blood pressure was 140 systolic, 64 diastolic; pulse was 84 and regular; respirations were 24, not labored; temperature was 97.6°F. The lungs revealed a pleural friction rub with somewhat diminished breath sounds at his left lower lobe area, no rales bilaterally, and moderate hyperresonance throughout. The abdomen was soft, slightly distended and exquisitely tender in the left lower abdominal quadrant and there was some tenderness also in the right upper and lower quadrants. The liver was palpable, extending three fingerbreadths below the costal margin. Peristalsis was inaudible.

The patient was admitted with a provisional diagnosis of acute diverticulitis, perforation of colonic diverticulum, and chronic arteriosclerotic heart disease. He was placed on a regimen of antibiotics, parenteral fluids and Wangensteen suction. Immediate laboratory studies revealed no anemia, a mild leukocytosis

(10,000 white blood count) and normal blood chemistry levels (sugar, urea, chlorides, carbon dioxide combining power, total proteins and A/G ratio). Electrocardiogram revealed myocardial damage and exhibited digitalis effect. Chest roentgenograms and scout films of the abdomen were not diagnostic. The abdominal pain was adequately controlled by moderate doses of demerol.® The initial temperature which was subnormal rose slightly and then rapidly developed into a spiking, septic curve. Cyanosis was improved by administration of oxygen by intranasal catheter but persisted for several days. Medical consultation soon after admission resulted in a diagnosis of acute congestive heart failure; therapy was instituted with satisfactory response.

On the third day following admission the patient began to have two to six stools daily which were liquid and brownish-red, chocolate-colored. Abdominal complaints and physical signs persisted with intermittent periods of relief for very short periods. Peristalsis was inaudible for seven days. After eight days the patient appeared sufficiently improved to discontinue suction and parenteral fluids and oral feedings were instituted. The temperature remained elevated and septic in type. The abdominal distress was minimal but slight, colicky pain recurred intermittently with periods of relief lasting several days at a time. The chocolate-colored stools, however, persisted but less frequently. During this period of about ten days the patient was taking liquids and a soft diet freely. Barium enema study at this time confirmed the clinical diagnosis of acute diverticulitis of the descending colon. No other abnormalities in the large bowel were noted.

On the nineteenth day of hospitalization the patient had a semi-liquid bowel action at which time he passed per anum within a few minutes a blackened, tubular, macerated piece of tissue measuring 45 cm. which proved on examination and histologic study to be a segment of ileum. The temperature continued as before. A gastrointestinal roentgenogram series revealed disturbed small bowel function and evidence of possible mucosal disease but no obstruction. Barium enema study, repeated at this time, revealed acute diverticulitis and no other abnormalities. The patient's general condition improved, but with persistence of the left lower abdominal distress it was elected to intervene by exploratory laparotomy.

Under spinal anesthesia the abdomen was opened through a left rectus incision and exploration carried out. A moderate amount of recently formed adhesions were encountered primarily in the left lower abdomen and pelvis. Following division of these adhesive processes, it was discovered that the small bowel was involved in an adherent mass to the left within the pelvis. The adherence of this mass to the lateral pelvic peritoneum was divided by blunt dissection with the fingers and the mass delivered into the wound. This consisted of a thickened, "double-barrel" segment of ileum with approximately 50 per cent of the circumference firmly adherent while the remaining half of the circumference was open, having been separate from its attachment to the pelvic peritoneum. It was immediately apparent that this was the site of intussusception and that spontaneous or auto-anastomosis had taken place; however, the anastomosis included in its formation the pelvic peritoneum to the extent that it was part of the end-to-end anastomotic line. Thus the continuity of the fecal stress was maintained and a complete obstruction averted by this curious mechanism following intussusception. Further exploration at this time revealed no other gross disorder except the presence of multiple diverticula of the descending colon. No connection was found between the sigmoid or descending colon and the anastomosis at the site of intussusception. The involved ileum was resected and side-to-side anastomosis performed. The immediate postoperative course was uneventful; however, the convalescence was characterized by a recurrence of left lower quadrant colic and a septic type temperature. In addition a fecal fistula now developed at the site of a stab-wound drain placed at the time of exploration. With this evidence of a perforation of a colonic diverticulum, transverse colostomy was performed. The postoperative period was uneventful, the abdominal distress did not recur and the temperature curve returned to normal within six days. The patient was discharged afebrile and asymptomatic on the sixty-third day after admission with instructions to return at a later date for definitive surgery.

COMMENTS

As is well known but may bear brief reviewing here, intussusception is primarily a disease of childhood and of infancy, particularly since

approximately 75 per cent of all instances occur under the age of two years, more than 50 per cent within the first twelve months and most of these between the fourth and ninth month of life.[1] The causative factor in the infant is usually not apparent; however, in the adult the causative factor usually is apparent and is frequently, in 70 per cent of instances,[2] a tumor of the bowel, a Meckel's diverticulum, intestinal ulcer or polyp.

A search of the literature revealed a report of 1,000 cases of intussusception by Fitzwilliams[3] and 400 cases reported by Perrin and Lindsay[4] without one case of slough of the intussusceptum and recovery following expulsion. Finestone,[5] in reporting an unusual case of intussusception complicating previous surgery, revealed his review of the literature for twenty years prior to 1946 produced only a few instances of spontaneous amputation of bowel followed by expulsion per anum with recovery. In addition his case and two unreported cases in the experience of Garlock[6] all represented phenomena wherein previous surgery had been performed on the patient, usually expulsion of the terminal ileum. Garlock's two cases were instances wherein terminal ileum was excluded following ileotransverse colostomy performed as a first stage procedure for terminal ileitis, and the intussusception, ileocolic, discovered inadvertently when ileocolic resection as second stage procedure was undertaken. Finestone's case followed a similar pattern with intussusception following previous ileosigmoidostomy; in his case the patient was relieved of symptoms following expulsion of the intussusceptum measuring 14 cm. in length. Since the single experience of the authors of this report Benson, Carpenter and Swedenberg[17] have reported the most recent experience occurring in 1950 and 1951. They reported two cases, one complicated by pregnancy and the other having trauma as a possible etiologic factor.

SUMMARY

1. A case of intussusception of the ileum with spontaneous anastomosis and spontaneous expulsion per anum of the intussusceptum and recovery is presented.
2. Intussusception is briefly discussed.
3. Reports of similar type cases are reviewed.

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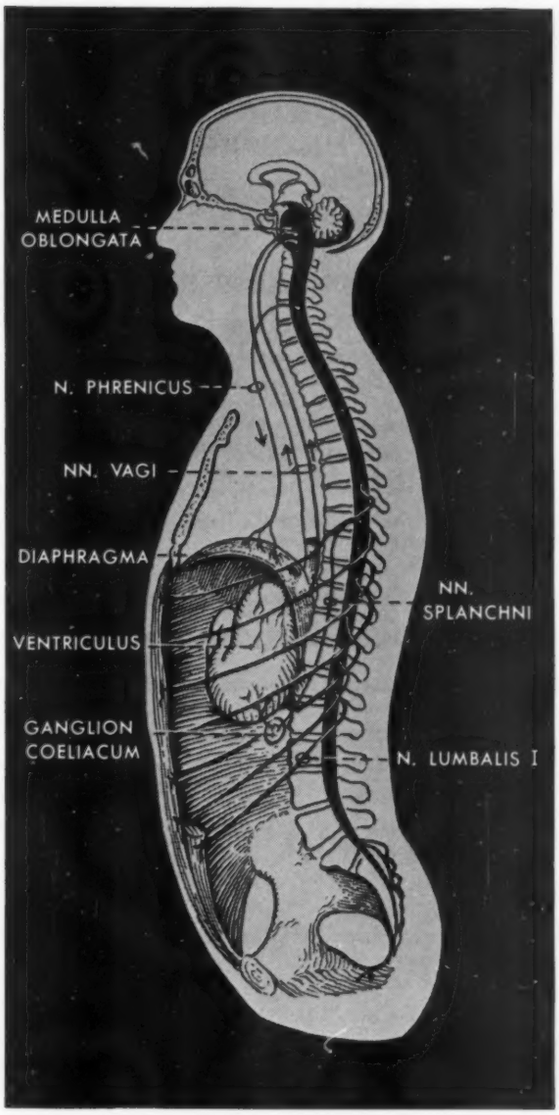

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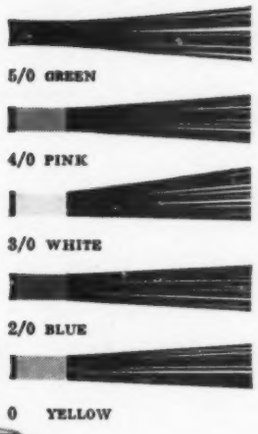

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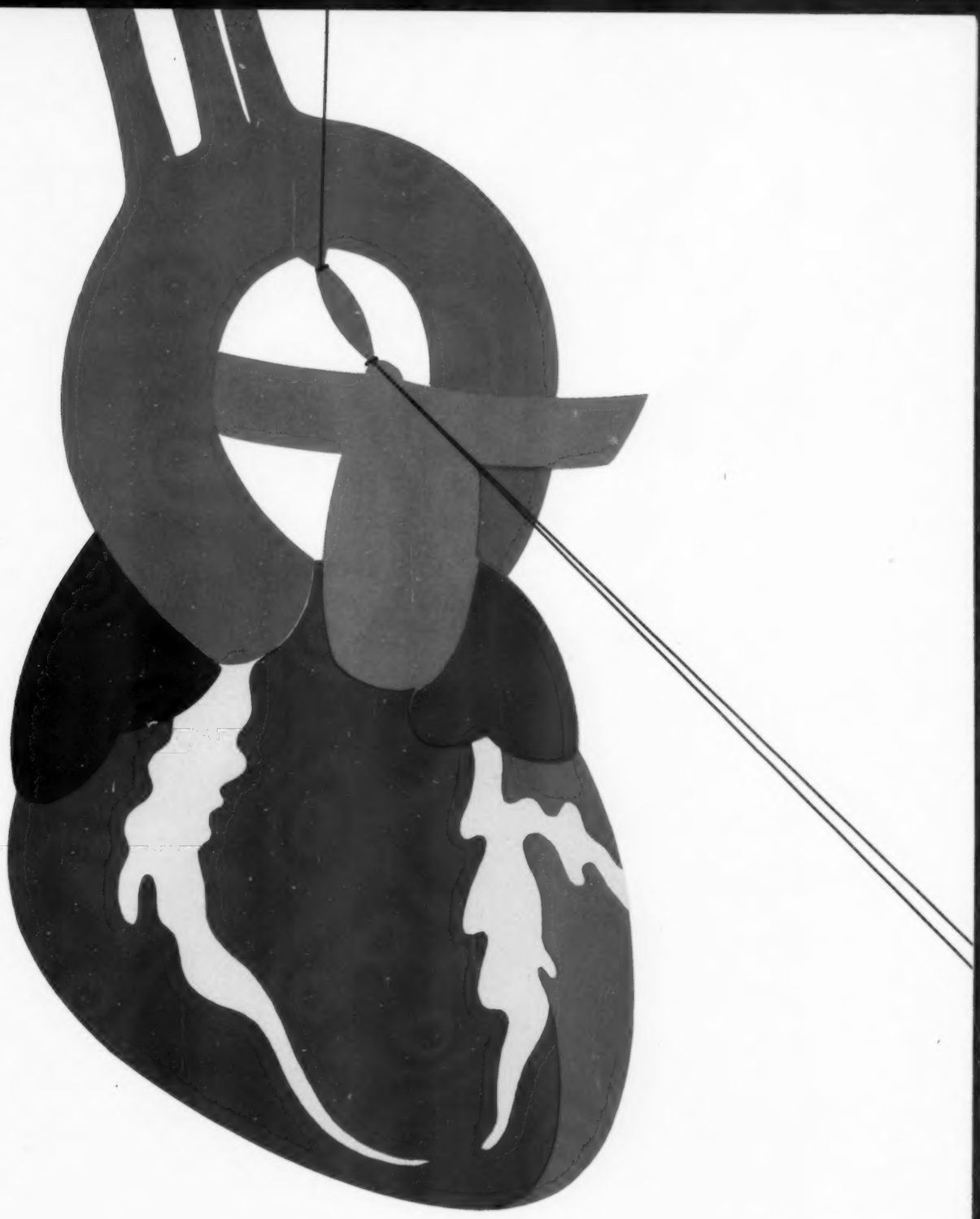

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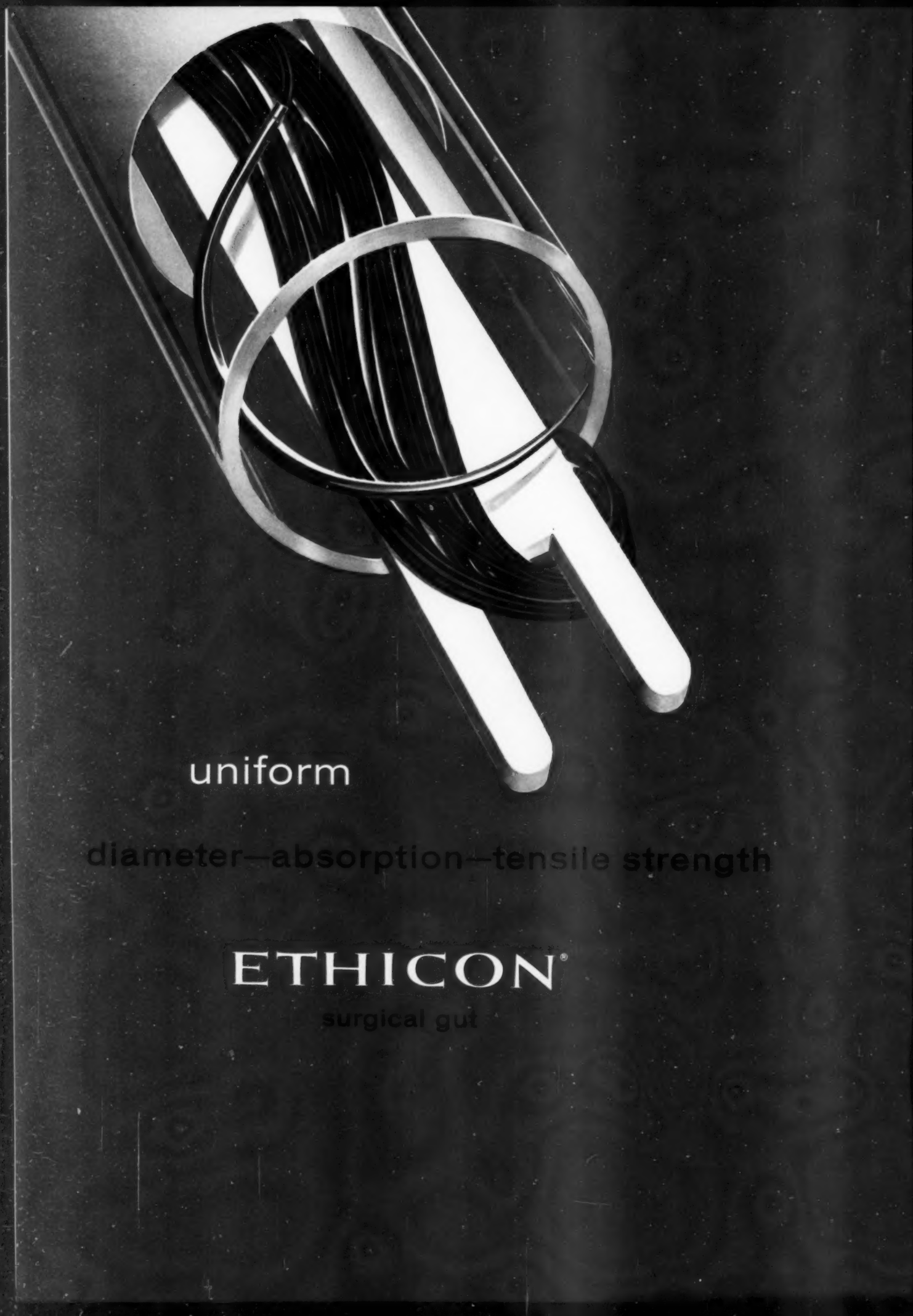
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1. Choy, D.S.J. and Wendt, W.E.: U.S. Armed Forces M. J. 3:1241, Sept. 1952.
2. Choy, D.S.J.: A.M.A. Arch. Surgery. *In Press.*

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NOTES AND QUOTES

A NEW method of administering injectable drugs, eliminating the need for sterilized equipment and at the same time avoiding any possibility of contaminating the injection needle, was introduced to the medical and allied professions by Wyeth Laboratories. The new dose unit is an improved Wyeth "Tubex," to which an injection needle is affixed, ready for use. A sterile rubber sleeve protecting the needle need not be removed until the moment of injection.

To use the new injection equipment, the physician loads the Tubex needle unit into a syringe just like loading a shotgun. A twist of the wrist engages threads at both ends of the tube to provide two-way control. Then the sterile sleeve is removed just before the injection is made. The syringe body need not be sterilized, since neither needle nor medicament can touch it.

The new Tubex is an improvement over injection methods now in general use. In one technic, the physician sterilizes a glass syringe and needle, then extracts the correct amount of medicament from a rubber-capped vial. The new Tubex units are to be used in a new version of the Tubex breech-loading syringes which Wyeth will provide at no charge with initial shipments to professional users. First products to be released in the new units are Bicillin "600"; Wycillin "300" and "600." Most of Wyeth's other injectable drugs will be available in the new Tubex units as soon as current stocks of old type are exhausted, a Wyeth spokesman said.

Soviet Russia, despite Communist claims, has presented no proof of making a single outstanding contribution toward the cure of disease or alleviation of suffering, said the head of a leading American pharmaceutical firm. Visitors to the twenty-fourth annual meeting of the Marine Historical Association at Mystic Seaport, Mystic, Connecticut, heard Mr. Francis Boyer, president of Smith, Kline & French Laboratories of Philadelphia state that despite extravagant claims from behind the Iron Curtain there was no evidence to point to progress in medicine.

MR. T. F. DAVIES HAINES, President of Ciba Pharmaceutical Products, Inc., of Summit, New Jersey, one of the large ethical pharmaceutical houses, has announced that the company has been conducting an intensive campaign during the past year against manufacturers who have marketed products having colors and shapes similar to distinctive tablets marketed by Ciba. Ciba conducted this campaign by having prescriptions for their products filled in various retail stores in the East, the South and on the West Coast. Chemical and physical analysis demonstrated that many of the tablets thus purchased were not manufactured by Ciba but were products of other houses who tacitly advertise pharmaceuticals for substitution. Strong protests were made to the offending houses and these were accompanied by threats to sue. As a result, many of the offending houses have agreed to discontinue selling any Ciba product substitutes. Several have surrendered or offered to surrender dies and punches used for the purpose; and other houses have agreed to use different shapes and colors for their products, submitting specimens of the new tablets as part of their stipulations.

The American Journal of Surgery, established in 1891, internationally known, independent monthly publication, has been honored as recipient of the first Honor Award for Distinguished Service in Medical Journalism to be given by the American Medical Writers' Association. The award, consisting of a plaque, was presented to the Editor of The American Journal of Surgery, Dr. Thurston Scott Welton of Brooklyn, N.Y., Emeritus Professor of Clinical Obstetrics and Gynecology, State University of New York. The presentation was made by the President of the Association on the occasion of the 10th Annual Meeting of the Association at the Abraham Lincoln Hotel, Springfield, Ill., September 23rd. The award is presented annually "for accuracy, clarity, conciseness and newness of information in articles, editorials and other material; for excellence of design, printing and illustrations, and for distinguished service to the medical profession," rendered by a United States or Canadian medical periodical. (From a release of the American Medical Writers' Association.)

WIDOWS predominate among the women marrying past midlife, according to a study just released by the statisticians of the Metropolitan

CONTINUED ON PAGE 46

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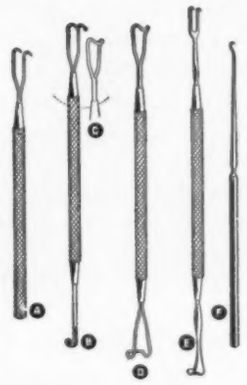

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NOTES AND QUOTES

Life Insurance Company. Using data from fourteen widely separated states, the report shows that in 1950 widows made up one-quarter of all brides at ages forty to forty-four, one-half of the brides at ages fifty to fifty-four and more than four-fifths of those at ages sixty-five and over. Surveying the total marriage picture, the statisticians point out that marriages at the later ages make up only a small fraction of the total. Widows and widowers accounted for only six per cent of the brides and grooms in the fourteen states. In about four-fifths of the marriages, the brides and grooms were entering matrimony for the first time. Among those marrying at ages under twenty-five, the proportion was well over nine-tenths. In marriages in which the bride or groom was twenty-five years of age or older, a considerable proportion had been previously divorced. Divorcees accounted for one-quarter of the brides at ages twenty-five to twenty-nine, the proportion rising to a maximum of nearly one-half at ages thirty-five to forty-four years. For grooms, the proportion previously divorced increased from about one-eighth among those marrying at ages twenty-five to twenty-nine and to one-half for those entering marriage at forty to forty-nine.

The Greek Government has officially extended appreciation to Parke, Davis & Company for the firm's donation of chloromycetin to the earthquake-stricken Ionian Islands. W. R. Jeeves, vice-president and director of overseas operations, said the Company's London office had received a letter from J. A. Phrantzes, Charge d'Affaires, Greek embassy, London, which said in part: "I have received instructions from my Government to express to you their deep appreciation and warmest thanks for the most generous and valuable gift of chloromycetin which your Company has so kindly despatched to Greece for the relief of the earthquake victims. I also wish to add my personal thanks for the immediate and effective way in which your Company has contributed to the relief of the unfortunate inhabitants of the Ionian Islands." The recent series of earthquakes severely damaged the islands, leaving hundreds dead and several thousand homeless.

THE National Foundation for Infantile Paralysis announces the availability of a limited number of additional postdoctoral fellowships to candidates whose interests are research and teaching in medicine and the related biological and physical sciences. The purpose of these National Foundation fellowships is to increase the number of professional workers qualified to give leadership in the solution of basic and clinical research problems including those of poliomyelitis and other crippling diseases. The fellowships cover a period of from one to five years. Stipends to Fellows range from $3,600 to $7,000 a year, with marital and dependency status considered in determining individual awards. Institutions which accept Fellows receive additional compensation for expenses incurred in relation to their training programs.

Eligibility requirements include United States citizenship (or the declared intention of becoming a citizen), sound health and an M.D., PH.D., or an equivalent degree. Selection of candidates is made by a Fellowship Committee composed of leaders in the fields of medical research and professional education. The designation "Fellow of The National Foundation for Infantile Paralysis" will be given to successful candidates. A total of 181 fellowship awards in these categories has been made by the National Foundation up to August 1, 1953. Complete information concerning qualifications and applications may be obtained from: Division of Professional Education, The National Foundation for Infantile Paralysis, 120 Broadway, New York 5, New York.

Since January, 1953, Sharp & Dohme, Division of Merck & Co., Inc., has made grants totalling $45,910 to thirteen institutions scattered throughout the United States and Canada, it was announced by L. Earle Arnow, M.D., Vice President and Director of Research of the Philadelphia pharmaceutical firm. Of the total amount, $33,910 has been awarded since April 1, 1953.

Among those institutions receiving grants were: Northwestern University, Johns Hopkins University, North Carolina Pharmaceutical Research Foundation, Inc., University of Texas School of Medicine, Cornell University, Columbia University, Wayne University, University of Montreal, Rutgers University, Princeton University,

CONTINUED ON PAGE 48

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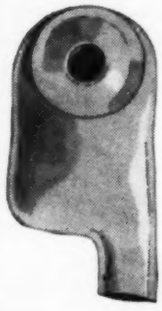

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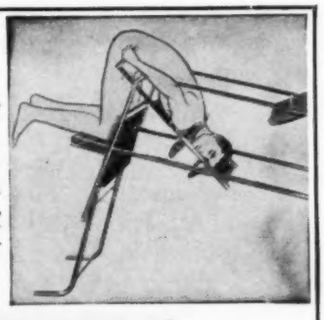

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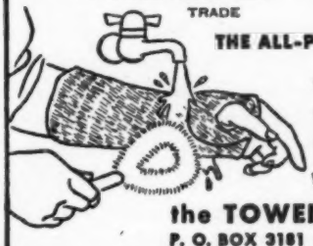

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NOTES AND QUOTES

University of Texas, Jefferson Medical College and Harvard University.

FORTY thousand doctors in twenty-two Western Hemisphere countries are advocates of a simple credo upon which the Pan American Medical Association was founded twenty-six years ago: "The practice of medicine has no national, racial or religious boundaries." This unequivocal formulation was conceived late in the year 1926 when a group of young physicians studying tropical diseases in New York City foresaw, long before the Good Neighbor Era, a great need for the interchange of medical knowledge between all parts of the Western Hemisphere. In furtherance of their credo, the aims and purposes of this organization of medical men were formally stated:

"To promote closer relations and better understanding among physicians and surgeons of the Western Hemisphere. To extend courtesies and hospitality to members of the medical profession visiting cities where Chapters of the Association are located. (That is, in all of the twenty-two American nations.)

"To grant post-graduate scholarships to physicians and surgeons from countries of the Western Hemisphere, and to interchange scholarships with accredited scientific institutions in such countries.

"To establish post-graduate medical teaching centers in various countries of the Western Hemisphere. To take other steps, involving no political policy, for advancing medical knowledge and strengthening through the medical profession, bonds of friendship among the peoples of the Western Hemisphere, including the interchange of physicians and surgeons between such countries for the purpose of presenting post-graduate courses in designated medical centers, the organization and holding of Pan American International Medical Congresses in the various countries of the Western Hemisphere, and the publication of a *Journal of the Pan American Medical Association.*"

Seventeen farsighted young doctors started the organization: Drs. Ruiz Arnau, F. H. Albee, Conrad Berens, Stanley Brady, Robert Brennan, Thomas Cherry, Isaac Hartshorne, Lee M. Hurd, Jerome Lynch, A. Judson Quimby, Damaso Rivas, Francisco Rivero, William Sharpe, Morrissett Smith, Uribe Troncoso, Julius Valentine, and Edgar White. Determined to do something about the problem which they all believed was important to the future of medicine, they met and solemnly founded the Pan American Medical Association, an organization that was destined to grow far beyond their dreams.

For almost two years the founders labored to enlist others in their fledgling association. They held frequent and very informal meetings and wrote letters—hundreds of letters. "We want," they wrote, "to promote friendship among professionals of the medical sciences throughout all the nations of the western world, to foster the exchange of knowledge and experience, to provide hospitality for physicians of Latin-American countries who visit New York, to develop medical literature of interest to all of us and, eventually, to hold scientific congresses in the various cities of the American countries." How well their hopes were realized is now a matter of history, the latest addition to which was an announcement by the Governors of the Ninth Congress (1954) expanding the post-graduate scholarship program through a plan to grant 3 three-year scholarships annually to physicians.

The University of Minnesota will present a continuation course in Fundamental Advances in Internal Medicine for Internists at the Center for Continuation Study next February 15 to 17, 1954. Basic concepts in the fields of infectious disease, gastroenterology and hematology will be discussed. The faculty will include Dr. Walter Lincoln Palmer, Professor, Department of Medicine, University of Chicago School of Medicine, and Dr. David Shemin, Associate Professor, Department of Biochemistry, Columbia University College of Physicians and Surgeons, New York City. Dr. Shemin will also present the annual Journal-Lancet Lecture on February 16th. The course will be presented under the direction of Dr. Cecil J. Watson, Professor and Head, Department of Medicine, and the remainder of the faculty will be made up of members of the University of Minnesota Medical School. Housing accommoda-

CONTINUED ON PAGE 50

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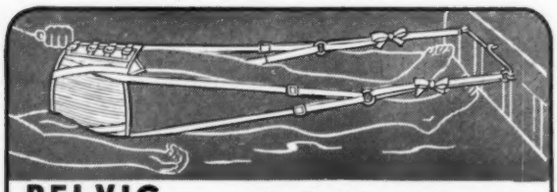

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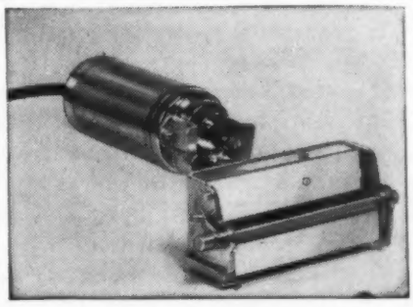

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NOTES AND QUOTES

tions at the Center for Continuation Study will be available for physicians registering for the course.

OBESITY is a disease which, like many other diseases, has multiple causes, and it cannot be explained entirely in terms of overeating, Dr. Fredrick J. Stare, a biochemist who is professor of nutrition in the Harvard School of Public Health, Boston, told the American Chemical Society's New York Section. While all observers agree that overweight is a result of an imbalance between energy intake and energy expenditure, the primary cause of this condition has remained largely unknown, said Dr. Stare, who spoke on "Chemistry and the Life Span."

"To explain obesity by overeating is not much more illuminating than to explain alcoholism by overdrinking," Dr. Stare asserted. "In the case of obesity the problem appears to be: what is the factor—or what are the factors —which have disturbed the mechanism of regulation of food intake in such a way that the energy balance is tipped in favor of excessive food consumption? In broad terms I think one can say that obesity, like many other diseases, has multiple causes. There are physiologic and psychologic causes. Undoubtedly they are interrelated, and contributions to either will help in a better understanding of the disease, and hence in prevention and treatment."

Because of its high incidence in this country, and because it favors the onset of many of the degenerative diseases, obesity was described by Dr. Stare as one of the most important problems in contemporary medicine and public health. It appears logical from work done to date that the cells of the brain which regulate appetite are sensitive to the level of sugar in the blood, the biochemist said. Experimental animals have been shown to eat more when the blood sugar level is low and less when this level is raised. The apparent contradiction of this theory in the case of diabetic patients who have large appetites and high blood sugar levels can be explained in terms of the inability of the blood sugar to penetrate to the brain cells owing to the diseased condition of the patient. "Blood sugar levels are related to the character of the diet and the timing of food intake," Dr. Stare commented. "Current studies attempting to apply this information may turn out to have a useful part in the prevention and treatment of some types of obesity—surely an important factor in the life span."

The National Research Corporation Scientific Trust has recently made a grant in the amount of $3,200.00 *for the support of scientific research to Thomas K. Sherwood, Professor of Chemical Engineering, for studies in the problem of "Evaporation at Low Pressures," at the Massachusetts Institute of Technology. The aim of the investigation will be the extension of basic knowledge of mass transfer between phases and the exploration of reported "barrier" to vaporization at low pressures. This trust was established in 1951 by the National Research Corporation of Cambridge, Massachusetts, to provide financial support in fields of basic research.*

DR. HENRY W. KUMM of Chocorua, New Hampshire and New York City, has been appointed director of research of the National Foundation for Infantile Paralysis. Dr. Kumm, who had spent twenty-three years on the staff of the Rockefeller Foundation for Medical Research before joining the National Foundation in July, 1951, replaces Dr. Harry M. Weaver of Bedford Village, New York, who has resigned. Well known for his part in the Rockefeller Foundation investigations leading to the control of yellow fever, Dr. Kumm also has done extensive work in the study of modes of transmission of yaws and the control of malaria. He conducted field studies of the epidemiology of yellow fever in Nigeria, West Africa, and was director of the Yellow Fever Laboratory in Rio de Janeiro from March, 1945, until that organization was turned over to the government of Brazil at the end of 1945. He spent two years in the British West Indies with the Jamaica Yaws Commission and represented the Rockefeller Foundation in malaria and yellow fever control work in Costa Rica, El Salvador, Panama, Colombia and Brazil. During World War II he served as civilian consultant to the Surgeon General of the U. S. Army in Italy, directing field studies of the use of DDT against malarial mosquitoes in the marshes near Rome and Naples.

CONTINUED ON PAGE 52

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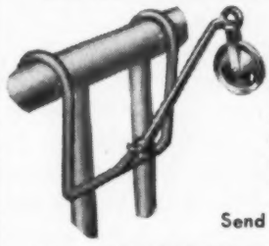

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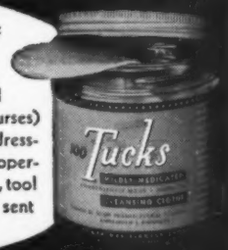

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NOTES AND QUOTES

Doctors at the 1953 Clinical Congress of the American College of Surgeons saw a new medical aid produced by a flour milling company. The new product is the Cel-O-Sorb Surgical Sponge, developed and manufactured by the O-Cel-O Division of General Mills. It is made from the basic cellulose sponge material produced by O-Cel-O, Inc., since 1946. The sponge is more compact, more efficient and less costly to use than present surgical sponges made of cotton gauze. They are more absorbent, and can be rinsed out and re-used during an operation. They reduce sponge usage, one cellulose sponge replacing ten gauze sponges in some types of surgery. This simplifies the counting and handling of sponges in operating rooms. In addition, the new product takes up only 5 per cent as much space as gauze sponges in hospital storage areas. Because of its soft texture this sponge is also gentle to tissues.

EXPECTATION of life among diabetics has increased substantially as a result of progress in the medical control of the disease and the introduction of insulin therapy, the Metropolitan Life Insurance Company's statisticians report. Analysis by the statisticians of the experience among many thousands of diabetics treated at the Joslin Clinic in Boston shows that no less than 35 per cent of recently deceased patients had lived twenty years or more after the onset of the disease, and that the list of causes of death is becoming more and more like that among non-diabetics.

Diabetic coma, which before insulin was the major cause of death among diabetics, was responsible for only 1.0 per cent of recent deaths. Death from infection, likewise, has been reduced to minor importance in the total mortality among diabetics, reflecting the generally improved condition of persons with the disease and the benefits derived from the use of the antibiotics and chemotherapy. A major proportion of the deaths was accounted for by heart disease of the coronary type, a condition which occurs earlier and develops faster in diabetics than in non-diabetics. The second largest cause, accounting for nearly one-eighth of the deaths, was renal disease. "The over-all picture shows a far better survival experience than was the case two decades ago. Further gains are in prospect as patients benefit from research into the disease and into insulin, and from advances in the field of medicine generally."

In 1950 the average lifetime of the American people reached a new high of 68.4 years. This represented a gain of twenty-one years since 1900—an extraordinary record of progress in life conservation. During the prior half century—from 1850 to 1900—the increase in average lifetime in our country was only seven years; before that the gains were even more gradual.

THE special care and attention needed by mentally ill patients with tuberculosis was emphasized in an editorial in the November issue of *The American Review of Tuberculosis*, journal of the American Trudeau Society, medical section of the National Tuberculosis Association. The gravity of the tuberculosis problem among the mentally ill is too little recognized, according to the authors, Abraham M. Balter and Michael Pilpel of the Veterans Administration Hospital, Lyons, N.J.; Harold S. Hatch, Morristown, N.J., and George N. J. Sommer, Jr., Trenton, N.J.

"The number of tuberculous patients varies with different (mental) institutions," the editorial states, "but, on the whole, it is much higher than in the general population. The reason for this increased incidence is obscure. Various theories are offered: that the psychotic undergoes some kind of metabolic change in which his resistance falls to such a degree that he becomes an easy victim of the disease; that the psychosis causes a person to eat poorly, to become dilapidated, and to be careless of himself; or that he is in intimate contact with unknown and undiscovered cases of active tuberculosis. Probably all factors are active. Whatever the reason, it seems that the incidence of tuberculosis is greatest in those patients who have been hospitalized for five years or more." The authors deplore the fact that too often, when the psychotic is placed in an institution, he is dismissed from mind and point out that the psychotic himself has withdrawn from the world of reality and "cannot or will not make known the discomfort resulting from his disease."

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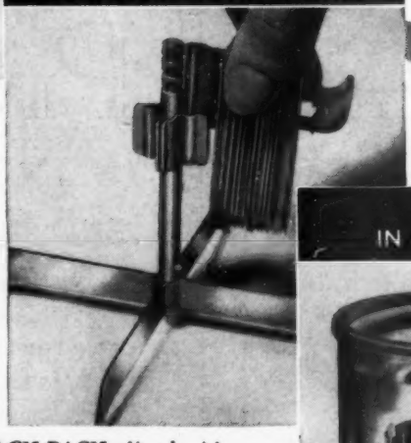

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ADVERTISERS INDEX

Abbott Laboratories....10, 37
Aeroplast Corporation....42–43
Air Mass, Inc.... 51
American Cystoscope Makers, Inc.... 22
American Hospital Supply Corp.... 4
American Orthopedic Appliances.... 45
Ames Company, Inc.... 1
Austenal Laboratories, Inc.... 30
Ayerst, McKenna & Harrison, Ltd.... 26
Bard-Parker Co., Inc.... 54
Barry Laboratories.... 53
Baxter Laboratories.... 4
Burroughs Wellcome & Co. Inc.... 38
Campbell Associates.... 47
Chatham Pharmaceuticals, Inc.... 20
Cochrane Physicians' Supplies, Inc.... 45
Cook County Grad. School of Medicine 34
Crescent Surgical Sales Co., Inc.... 53
Cutter Laboratories.... 6
Davis & Geck, Inc.... 13
J. A. Deknatel & Son, Inc.... 35
DePuy Manufacturing Co....28, 53
Dome Chemicals, Inc.... 39
Drug Publications, Inc....24–25
Duke Laboratories, Inc.... 39
Eder Instrument Co.... 47
Electro Therapeutic Instrument Co.... 53
J. H. Emerson Company.... 53
Ethicon Suture Laboratories, Inc....
Insert Facing Page 38
C. B. Fleet Company, Inc.... 36
Fuller Pharmaceutical Company.... 51
John F. Greer Company.... 51
Hoffmann-LaRoche, Inc....
Insert Facing Page 16
Kansas City Assemblage Co.... 49
Lanair Chemical Corp.... 51
Lederle Laboratories....18–19
Eli Lilly & Co.... 32
Little Manufacturing Co.... 51
MacGregor Instrument Co.... 49
The S. E. Massengill Co....17, 29
Medical Aids, Inc.... 47
V. Mueller & Co.... 15
N.Y. Polyclinic Medical School & Hospital.... 34
Notes and Quotes....44, 46, 48, 50, 52
Orthopedic Equipment Co.... 51
Orthopedic Frame Company....45, 47
Parke, Davis & Company.... 31
Murle Perry.... 45
Pfizer Laboratories, Division of Chas. Pfizer & Co., Inc....8, 12, 40–41
George P. Pilling & Son Co., Inc.... 23
The Radium Emanation Corp....45, 47
H. V. Rutzen & Son.... 47
Schenley Laboratories, Inc.... 27
The Scholl Mfg. Co., Inc.... 51
Seal-Ins Laboratories, Inc.... 49
G. D. Searle & Co.... 33
The Surgeon's Mart....45, 47, 49, 51, 53
The Torbot Company, Inc.... 45
The Tower Co., Inc.... 47
The Upjohn Company.... 21
Wallace & Tiernan Products, Inc.... 49
Wilmot Castle Co.... 14
Winthrop-Stearns, Inc.... 2
Wyeth, Inc.... 16
F. E. Young & Co.... 45
Zimmer Manufacturing Co.... 49

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